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SINKING THE BROOKLYN CAISSON FOR EAST RIVER BRIDGE NO. 3.—[See page 381.]

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NEW YORK, SATURDAY, MAY 31, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates

FIREPROOF MAIL CARS

The Editor has received from a California correspondent a clipping from a recent Washington, D. C., paper, which states the Post Office Department has been informed that in a recent railroad wreck in Arizona, the entire mail, which came from southern and central Californian points, was destroyed. Our correspondent reminds us that on several occasions in recent years the heavy overland mail from the Pacific Coast on its way eastward was entirely destroyed by fire. He asks whether we are not very much behind the times in the matter of the safe transportation of the United States mail, and whether the postal cars, on the overland routes at least, should not be made of steel, or constructed by some method that will be fire and collision-proof.

We think that the point is well made, and that the postal authorities would be justified in offering inducements to the various railroads, and particularly to the transcontinental systems, to improve on the present mail cars along the lines suggested by our correspondent. Such an inducement might reasonably take the form of a slightly higher mail subsidy where such cars are used. As to what form of car would afford the most complete protection against injury by collision and subsequent fire, we have little doubt that an all-steel construction would be better than an attempt to secure fire protection by the use of any so-called fireproofed wood. A mail car with the floor and framing built up of channel-iron and angles, and with sides and roof of sheet steel, would not only be proof against absolute loss by collision, but would of course be completely fireproof. If practical evidence be needed upon this point, we have but to refer to the many photographs which have been published in the last few years showing the extraordinary resisting qualities of pressed-steel cars, when they are subjected to the terrific impacts of colliding freight trains. They retain their general form, and frequently come out of such collisions practically uninjured, while the wooden cars adjoining them have been smashed into the proverbial kindling wood. The effects of collision upon the cars of a passenger train are, of course, nothing like as heavy as those in a freight train weighing three or four times as much; and we venture to say that all-steel mail cars would pass through a collision and preserve their contents practically intact. We commend the suggestion of our western correspondent to the serious consideration of the postal authorities.

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EARLY USE OF THE WATER-TUBE LOCOMOTIVE BOILER.

The increased attention that is just now being directed to the water-tube boiler for locomotive service is a significant fact in the development of locomotive engineering. We recently illustrated in the SCIENTIFIC AMERICAN a very successful type, which is now in service on the Southwestern Railway, England; and we have reason to believe that before long there will be other attempts, both in this country and in England, to secure in locomotive service the superior advantages which the water-tube boiler has shown itself to possess for certain classes of work at sea and in stationary practice. Those of our readers who believe that the water-tube boiler locomotive is an entirely modern improvement, will be surprised to know that in the early days of steam railroads and, indeed, only a little less than a half a century ago, the Dimpfel locomotive was built with a boiler which was strictly of the water-tube type, and that this boiler gave most excellent results both in firing and steaming. The boiler contained a square firebox and a single, horizontal flue. A large number of small-diameter iron tubes led down through the crown sheet of the firebox, and were curved around to pass horizontally through the flue. The engine steamed remarkably well, the circulation being very thorough; moreover, the combustion was more perfect than with many modern fire-tube boilers, the large amount of air space between the flues allowing a perfect combustion of the gases. Although its firing and steaming qualities were so good, the boiler was not a practical one, for the reason that to get out a defective tube that might be in the center of the nest, it was necessary to tear the whole system of tubes to pieces.

In a later attempt to design a water-tube locomotive boiler in this country, the main central flue through the barrel was made hexagonal in cross section, and the tubes ran athwart the flue between opposite faces. This also proved to be an excellent steamer, but like its predecessor, was exceedingly troublesome in repairs, it being necessary, if a defective tube had to be repaired, either to remove the main flue altogether, or drill through the outer shell of the boiler, remove the tube and plug up the hole. The invariably excellent results obtained with the water-tube system should stimulate engineers to give persistent attention to this problem until a thoroughly practical boiler of this type has been produced.

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DANGERS OF PEDDLED ICE CREAM.

The ice cream season is at hand, and the street vendor is doing a thriving business among school children and street urchins. Few people realize what a menace to health is found in the sale of this delicacy. Medical authorities are beginning to realize that it is an important factor in the spread of disease. A number of cases have recently been observed in which symptoms of irritant poisoning and even death were the result of eating ice cream bought of street peddlers. A coroner's inquest held in London not long ago attributed the death of a six-year-old boy to unwholesome ice cream. The British Medical Journal in an article on this case recalls a bacteriological investigation of Dr. Klein's, in which some ice cream and the water used for rinsing the glasses containing it were found to be swarming with thousands of microorganisms. The article refers also to a recent case of poisoning in Antwerp, where twenty persons were made ill from the use of ice cream, and it goes on to describe the causes of the danger. Contamination of the cream arises from the habitual filthiness of the Italian vendors. The commonest and stalest materials are used in its manufacture, and at night it is usually stored under the merchant's bed in his dirty tenement lodgings. The next morning, no matter how far gone in decomposition the unsold cream may be, it is rehashed and frozen for the day's business. The public at large seems to have the impression that bacteria are destroyed by the freezing process. This is not, however, the case, for the activity of the bacteria is only temporarily retarded by the cold, and during the nightly respite they thrive vigorously. In addition to all this, every opportunity is afforded for transference of diseases between the customers, for the glasses and spoons are never washed, but are merely rinsed in water that accumulates the filth of the entire day.

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THE EXPANSION OF OUR FOREIGN COMMERCE.

In the course of an address recently delivered by the Chief of the Bureau of Statistics, before the Manufacturers' Club of Philadelphia, Mr. Austin gave a very luminous explanation of the causes and extent of the expansion of our foreign trade, an expansion which in suddenness and magnitude has never been approached in the history of any other country. This phenomenal growth is the natural consequence of the rapid expansion of production which followed the great development in railway construction in the closing quarter of the nineteenth century. Following the construction of the transcontinental line which was completed in 1869, came the extension of other lines through the great Mississippi Valley and the South, and this resulted in the opening of the great agricultural, forest and mineral areas, whose natural supplies have made this the greatest producing country of the world; while the multiplication of railways facilitated the assembling of these natural products for use in manufacturing. As a result, agricultural production has doubled, while the output of coal, pig iron, and particularly of steel, has increased many fold. The result of all this is that the United States has become the greatest exporting nation in the world, having risen from fourth place in 1870 to first place in 1901. The value of our exports during that time has practically quadrupled, while imports have scarcely doubled.

The causes of this wonderful development in exports, in Mr. Austin's opinion, are to be found in the fact that the United States is the world's largest producer of the great articles required by man for his daily life, viz., food, clothing, heat, light, and manufactures. The principal articles of food are breadstuffs and meat, and of wheat and meat the United States produces more than any other country, while we raise more corn than all other countries combined. For clothing the article of largest requirement is cotton, and of this the United States produces more than three-fourths of the world's supply. For heat, coal is the greatest requirement, and of this the United States is now the world's largest producer, and our supply exceeds that of any other country; while for light our production of petroleum furnishes a larger quantity of refined illuminating oil than that of any other nation. Our manufactures also are nearly double those of the United Kingdom, and nearly equal to those of France, Germany and Russia combined.

This commanding position in the world's commerce is, in Mr. Austin's opinion, likely to be retained by the United States. The power of production shows no signs of abatement, while we may reasonably expect that the development of science and invention and the application of American energy will still further reduce the cost of production and transportation. This high standing of the United States as an exporting nation will, Mr. Austin said, be welcomed by the commercial world rather than antagonized, as has been intimated and feared in certain quarters. The world buys the products of our fields and factories because it requires them for daily use, and because it can obtain them more readily and cheaply from the United States than from any other part of the world. Suggestions of the exclusion of American products of the field or factory seem scarcely likely, in Mr. Austin's opinion, to be realized. The effect of the refusal of Europe to purchase from the United States any of the great articles of which we furnish so large a proportion of the world's supply would be to cause an advance in the price of those articles in other parts of the world. The United States supplies one-fifth of the wheat entering into international commerce, three-fourths of the cotton, and practically all of the corn; while our proportion in the meat supplies of Europe is also large. To thus eliminate our production from the world's supply of these great articles of daily requirement would be to cause an advance in the prices of the limited supplies which could be obtained from other parts of the world. Hence, in these natural products, it may be expected that the demand will continue indefinitely, while the fact that the United States in 1901 sold to Europe alone more manufactures than she had ever sold to the entire world in any year prior to 1895 shows the progress that American manufacturers are making in Europe, the great manufacturing center of the world.

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THE IMPERFECT DEFINITION OF THE PHOTOGRAPHIC IMAGE ON DRY PLATES.

Messrs. Lumiere and Perrigot have been studying the question of obtaining the maximum degree of sharpness in photographic images. When examined by the microscope, the optical image given by a good objective is found to be incomparably sharper than that of the negative which is obtained under the same conditions. In fact the photographic plate registers an image which seems sufficiently sharp when viewed by the eye alone, but cannot support an enlargement by the microscope. In examining the causes of this lack of sharpness, the experimenters were led to find a method for obtaining negatives under the best conditions. One of the principal causes is the influence of grain in the sensitive film. It is well known that the bromide of silver in the emulsion is in the form of small grains whose dimension varies with the sensitiveness of the emulsion. They made a series of exposures using plates which were prepared by a series of emulsions of very different sensitiveness from the extra-rapid, corresponding to the grains of silver bromide of the maximum dimensions, to the limit of slowness, which is found in the special emulsion used in the Lippmann process of color photography and in which no grains are visible under the microscope, even with the greatest magnifying power. They thus find that it is the granulation of the sensitive layer which is the main cause of the want of precision in the images; the particles of bromide diffuse the light which falls upon them, spreading out the image and diminishing its sharpness in greater proportion as the particles are larger.

Another cause lies in the errors of focusing, even though these may be small. In an ordinary apparatus only an approximate focus is obtained. The use of a simple hand-glass to examine the image, the non-coincidence of the ground glass and the plate, also the want of flatness in the latter are causes which influence the focus. The experimenters fix the limit of movement for obtaining a clear image, and find it to be 1-100th of an inch. The influence of chromatic aberration may be found in the case of inferior objectives which have not been sufficiently corrected, but for the best lenses this is practically nil. Another cause lies in the use of the diaphragm. While in astronomical work and for the opposite extreme, microscopical work, it is desired to increase the opening of the objective, in photography, on the contrary, it is generally admitted that greater precision is obtained by the use of the diaphragm. The experimenters show that this is not always the case. The

diaphragm increases, in fact, the general sharpness of the images by correcting certain aberrations and especially by increasing the depth of focus, but if the central part of the image is considered, and admitting that the objective is already sufficiently corrected for aberrations, it is found upon enlarging the image considerably that its precision is greater as the opening of the objective is larger. The experiments show, in general, that when it is desired to obtain an image of great precision which may be considerably enlarged it becomes necessary to use plates which have no appreciable grain, such as those of the Lippmann process, to use the best possible arrangement for obtaining the focus, also to be assured of the value of the objective, especially as to the corrections of aberrations, and when a chemical focus is found, to allow for this. If the aberrations are sufficiently corrected in the lens, the maximum opening should be used.

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THE HEAVENS IN JUNE.

BY HENRY NORRIS RUSSELL, PH D.

The finest region of the sky which is now visible is that near the eastern horizon. It contains the brightest part of the Milky Way, which is here divided into two parallel streams, and diversified with many knots and patches of unusual brightness. At our usual hour of 9 P. M. on June 15 it is well clear of the horizon. Along its course lie a number of conspicuous constellations—Cygnus in the northeast, Aquila south of it, and Scorpio low in the southeast, not yet completely risen. Lyra and Hercules are higher up in the east, and Ophiuchus fills most of the southeastern sky. Corona Borealis and Boötes are overhead. Virgo is the most conspicuous constellation in the southwest, Leo in the west, and Ursa Major in the northwest. Gemini and Auriga are just disappearing. Draco and Ursa Minor are above the Pole, and Cassiopeia below it.

THE PLANETS.

Mercury is evening star at the beginning of the month, and sets about an hour and a half later than the sun. He should be easily visible after sunset, just below the bright stars Castor and Pollux. As he comes into line between us and the sun he disappears from the evening skies. On the 23d he passes through his inferior conjunction, and early next month he will reappear as a morning star.

Venus is morning star in Aries and Taurus, rising more than two hours before sunrise.

Mars is morning star in Taurus. At the end of the month he rises an hour and a half before the sun, and may again be seen.

Jupiter is in Capricornus, rising before midnight on the 1st, and at about 9:30 P. M. on the 30th.

Saturn is on the boundary of Sagittarius and Capricornus, rising rather more than an hour before Jupiter.

Uranus is in opposition on the 10th, and at his nearest for the year. At this time he is in right ascension 17 h. 13 m. and declination 23 deg. 6 min. south. He may be identified with the aid of a star map. Those without such help may find him by means of Theta Ophiuchi—a third-magnitude star about half way between the head of Scorpio and the Milk Dipper in Sagittarius.

Uranus is about 2 deg. north, and a little west of this star, and should be directly above it at about 10 P. M. The planet's pronounced greenish color will aid in identifying him; but the only sure test is his motion. By comparing two sketches, made a week or so apart, of the stars visible with an opera glass in this region, the planet can be certainly identified. On account of his low altitude, he is barely visible to the naked eye.

Neptune is invisible, being in conjunction with the sun on the 23d.

The asteroid Vesta, the brightest of the more than 400 planets of this group, comes to opposition early in July, under unusually favorable circumstances, being just visible to the naked eye.

We defer fuller comment till next month, only noting that on June 26 the small planet passes just south of Saturn, being but half a degree distant, and can easily be picked up with a field-glass. It is moving toward the bowl of the Milk Dipper, at the rate of a degree in four days.

At four o'clock on the morning of June 22, the sun enters the sign of Cancer, and, in the language of the almanacs, "Summer commences." But at this time the sun is in the constellation of Gemini, and he will not enter that of Cancer for a full month to come. Here is a great discrepancy, which demands explanation. How does it happen that the signs of the zodiac, while bearing the names of the constellation, do not agree with them in position?

The fact is, that, when the signs of the zodiac were named, they coincided with their respective constellations; but, during the 2,000 years that have passed since then, the signs have moved, while the stars have stood still, so that they no longer agree.

The signs of the zodiac have their positions fixed by the equinoxes—the intersections of the ecliptic with the celestial equator. The ecliptic moves but little among the stars, but the equator shifts its position in such a way that the equinoxes, carrying the signs of the zodiac with them, travel entirely round the ecliptic in a little over 25,000 years.

During the last 2,000 years they have moved westward about 30 deg., so that each sign has "backed" into the constellation which originally preceded it.

Partly on account of the resultant confusion, the signs of the zodiac are no longer used in astronomical calculations. Their appearance in the almanacs in the present connection is the last survival of a method of reckoning better adapted to the days of astrology than to the present time.

This change in the position of the equinoxes is called precession. It is due to the attraction of the sun and moon on the bulging equatorial regions of the earth—which, it is well known, is not exactly spherical. This action combined with the earth's rotation, causes its axis to move, in very much the same way that gravity, acting on a spinning top, causes its axis to revolve about a vertical line, instead of making it fall over.

THE MOON.

New moon occurs on the morning of the 6th, first quarter on the afternoon of the 12th, full moon on the evening of the 20th, and last quarter on the afternoon of the 28th. The moon is nearest us on the 5th, and farthest away on the 18th.

She is in conjunction with Venus on the 3d, with Mars on the 4th, with Neptune and Mercury on the 7th, with Uranus on the 20th, with Saturn on the 23d, and with Jupiter on the 24th.

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INSPECTION OF GAS METERS.

BY ALTON D. ADAMS.

Illuminating gas manufactured in the United States during 1900 had a value of $69,432,582, according to the Federal Census of that year. Substantially all of the gas valued at this great sum was measured out to consumers through meters. These facts are sufficient to show that accuracy in gas meters is highly important to the public at large.

The office of a gas meter is to automatically record on its dials the number of cubic feet of gas that pass through it. After such a record is made by a meter the consumer is liable to pay accordingly, unless it can be demonstrated that the operation of the meter is inaccurate.

To guard the interests of consumers Massachusetts has for many years required that all meters, through which gas is to be supplied to customers of public systems, be tested and sealed by the State Inspector of Gas before they are put into use. Moreover, any consumer of gas from the public supply may apply to the State inspector to test the meter through which his gas passes. A meter is considered correct under the law if it registers within two per cent of the actual number of cubic feet of gas passing through it. Meters are owned by the gas companies, and they are subject to fine if they supply any meter for the use of consumers that does not have the seal of the State inspector. Meters are liable to get out of order, however, though once correct, and any company is at liberty to reinspect its meters as often as it thinks proper. If a meter tested by the State inspector at the request of a consumer proves to be correct within two per cent, the cost of inspection, amounting to about one dollar, exclusive of transportation charges, is collected from the customer. If the meter is not correct the gas company owning it must pay all charges.

Under these regulations all of the new or repaired meters put into service by the gas companies each year are first submitted to the State inspector for his test and seal. The numbers of new and repaired meters thus tested before being put into use increased from 13,412 in 1889 to 27,451 in 1895 and 35,319 in 1901. When any of the new or repaired meters are found to be incorrect they are returned to the companies that presented them, and must be changed and resubmitted for test before they are used. The rising numbers of these tests serve to illustrate the importance of the work in which the State inspector is engaged.

Besides the meters just considered, the State inspector tests many other meters every year that are complained of as being inaccurate while in use. Records of such meters are here presented for each decade, beginning with that of 1872:

Year	Meters Tested	Meters Fast	Meters Slow	Average Per cent Fast	Average Per cent Slow
1872	202	87	33	4.80	9.55
1881	141	41	28	5.08	6.44
1891	230	52	34	4.74	10.06
1901	943	456	71	4.76	7.89

As the law only requires a meter to be correct within two per cent, all of the meters recorded as fast or slow were wrong by more than that amount. A meter is said to be fast when it records more gas than passes through it. A slow meter does not record all of the gas that passes through it. The per cent fast or slow as given is the average of all the meters that were fast or slow by more than two per cent in each year.

The number of meters tested after complaints has greatly increased since 1890, being more than four times as great in 1901 as it was in 1891. The per cent of fast meters to the total number tested in each year has also materially risen during the period. In 1891 this percentage was only 22.6, but for 1901 it stood at 48.3. The ratio of slow meters to the total tested on complaint has changed at a less rapid rate. For 1891 this percentage was 14.7, but in 1901 it dropped to 7.6. During the entire period since 1872 the average percentage of error for meters fast by more than the legal limit has been between four and six. For the same years the percentage of error in meters slow by more than the legal limit has been as low as 5.02 and as high as 23.60, but shows no permanent tendency to either increase or decrease.

During the eleven years of 1891 to 1901 inclusive 6,913 meters were tested as the result of complaints. Of this total number tested, 3,500 meters, or 50.6 per cent, were correct within the legal limit, 2,680 meters, or 38.7 per cent, were fast, and 660 meters, or 9.5 per cent, were slow. Seventy meters, or about one per cent of the total number, did not register any of the gas passing through them, and seven meters would not allow any gas to pass. One meter varied on test from four per cent fast to eighteen per cent slow. From this it appears that the number of fast meters was four times that of slow meters.

The average percentages by which meters are fast or slow have been taken from the official records, but it seems clear that the percentages for slow meters have been computed on an incorrect basis, or at least in a way liable to mislead. The actual amount of gas passing through a meter should be taken as 100 per cent in every case. If this is done the meter may be fast by any percentage, but it can never be more than 100 per cent slow. In the official record the amount of gas actually passing through the meter seems to have been taken at 100 per cent for fast meters. For slow meters, however, the record of the meter dials seems to have been taken at 100 per cent, and the actual amount of gas passing the meter divided by the slow dial record. On this plan, if a meter registers only one-half of the gas passing through it, the meter is said to be 100 per cent slow, when it is actually only 50 per cent slow. This method no doubt explains the higher figures of percentages given for slow than for fast meters, also the cases where meters are said to be more than 100 per cent slow, which follow:

From 1893 to 1901 inclusive the total number of slow meters tested on complaint was 577. Of this number 163 meters were between 2 and 5 per cent, 276 meters between 5 and 10 per cent, and 57 meters between 10 and 15 per cent slow. The percentages for the remaining slow meters range from 16 to 237, as given in the official reports, 7 being above 100.

During the same period, from 1893 to 1901, the number of meters complained of that proved to be faster than the legal limit on test was 2,521. Of these meters, 1,599 were between 2 and 5 per cent fast, 798 were between 5 and 10 per cent fast, 97 were between 10 and 15 per cent, and 19 between 15 and 20 per cent. Two meters were 20, three were 22, one was 27, one was 23, and one meter was 36 per cent fast.

It should be held in mind that all of these meters were tested by the State inspector before they were put into use, but subsequently grew inaccurate. What the conditions of meters may be in States where they are put into service without official test, and where there is no public inspector to whom consumers can appeal, may be surmised but cannot be stated.

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British trade, which has been somewhat on the decline for some time past, is now showing a sharp revival. The trade returns for the year 1901 show tremendous drops in the imports of certain raw materials for manufacture, aggsegating some $35,000,000. Especially is this the case in connection with gutta percha, the imports of which have declined about 40 per cent. The imports of raw materials for textile manufacture, however, on the other hand, show an increase of $10,000,000. In the shoe trade there has been a great increase in exports to British South Africa, due to the military demands. Elsewhere there has been a decline. Foreign imports of boots and shoes, however, have risen in the year from $3,473,490 to $4,694,565. The returns do not show the separate countries from which the imports have come, but doubtless this country has supplied the largest share. With regard to the exports, the construction of ships for foreign countries was abnormally heavy. Healthy advances were also shown in the manufacturing of yarns and textile fabrics for abroad. The foreign demand for apparel and articles of personal use showed a decided increase. British railroad material is again in nearly as good demand as two years ago. The value of British locomotives sold abroad is steadily rising, and the demand for English telegraph wire has grown by leaps and bounds having increased considerably over 100 per cent in two years.

PROGRESSIVE-MOTION ORE-CONVEYER.

A form of ore-conveyer that has met with considerable success in Germany is manufactured by Maschinenfabrik und Mühlenbauanstalt G. Luther, of Brunswick, Germany. The conveyer is made of sheet metal and moves horizontally on roller-bearings. Angle irons are used wherever required. The material to be transported is discharged at one end or at any desired portion of the conveyer, and is moved along in one direction until the point of discharge is reached. The speed of transportation is constantly accelerated, until finally the load is discharged at the turn of the conveyer. Experience has shown that the operation is well nigh faultless, and that during the forward travel of the first period of the return, all the material is thrown off. An amount of material varying from 30 to 150 tons per hour can be conveyed with an expenditure of 4 to 25 horse power. The length of the conveyer is dependent only on the particular cross-sectional form selected. The conveyer is intended for the transportation of coal, ashes, sand, ores, beets, sugar, produce and the like. If coke is to be transported, or some similar material that wears away the metal, a glass bottom is employed. The speed of rotation of the driving-shaft is dependent entirely upon the character of the material to be conveyed, and varies from 60 to 100 revolutions per minute, or about one-third of that of ordinary progressive motion conveyers.

A PROGRESSIVE MOTION ORE-CONVEYER.

THE UNVEILING OF THE ROCHAMBEAU STATUE.

BY EDWARD W. BYRN.

On Saturday, May 24, 1902, the two great republics of the world joined in the celebration of an international event which carries the thought of the American patriot back to the struggles of his ancestors for independent existence.

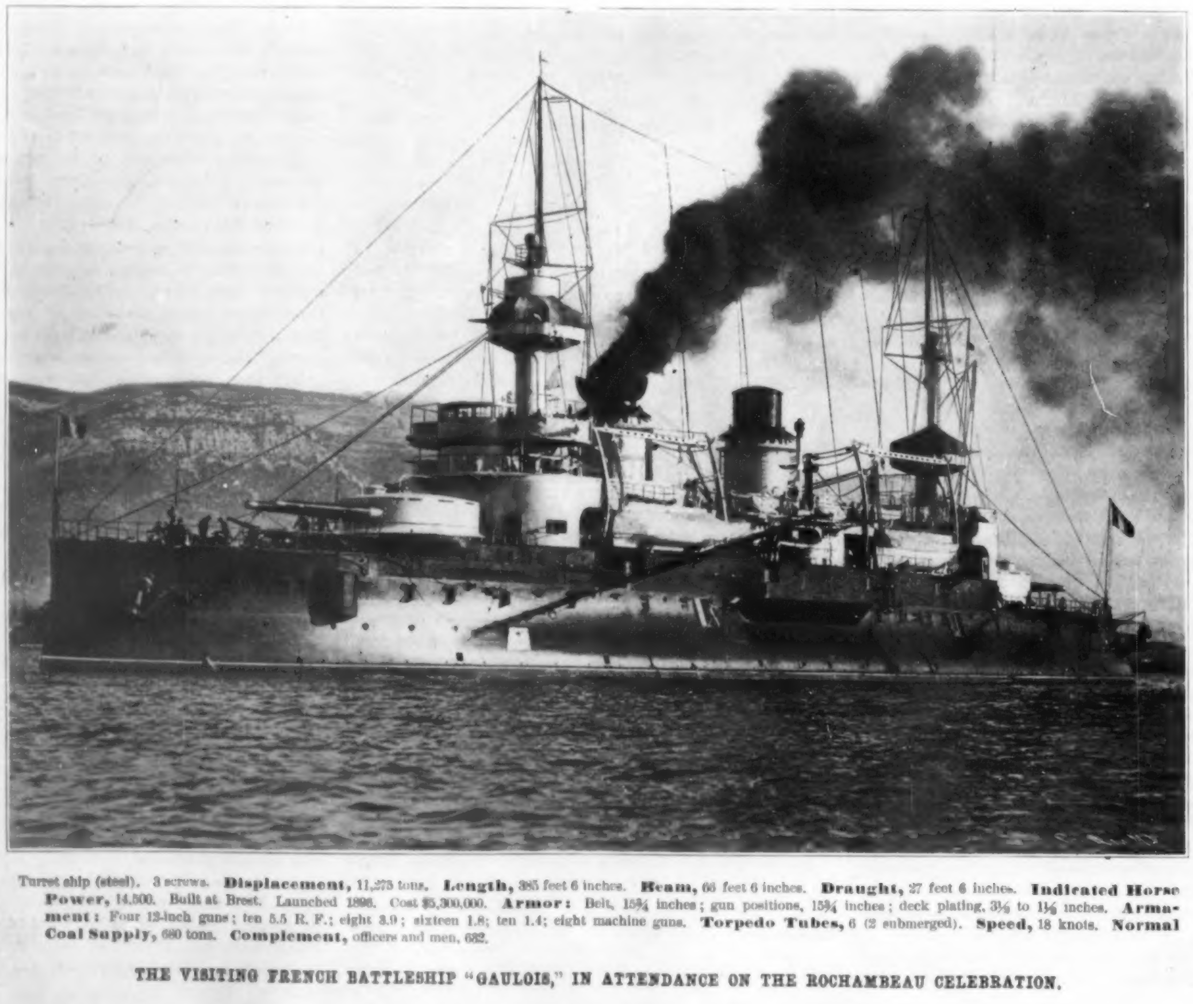
The unveiling of the statue of Jean Baptiste Donatien de Vimeur, Count de Rochambeau, was something more than an ordinary function. It was the occasion of a remarkable gathering of representative men of the United States and France, and one in which the armies, the navies and the civil governments of both nations united to do honor to the soldier who was the official representative of the French government, and who with French money and French arms and French men extended the helping hand to the Colonies. The story of Lafayette's generously voluteered services is already known to every schoolboy, but it remained for the first Congress of the twentieth century to do substantial honor to Rochambeau. The credit for the initiative in this worthy tribute is due to Mr. Jules Boeufve, the French Consul and Chancellor of the French Embassy, who as early as 1899 first suggested it. A year later the first bill was introduced in the United States Congress, and on March 3, 1901, a bill was passed and approved appropriating $7,500, and in the following year a second appropriation of $15,000 was secured, which amounts have since been further supplemented by other sums for the entertainment of guests sent by France to our shores to celebrate the event.

Immediately in front of the White House at Washington, and facing its grounds and closer than any other public reservation, is Lafayette Square, so called for many years after the French general who gave his services to the cause of the American Colonies in their struggle for independence. At the southeast corner of this square stands the Lafayette monument. At the southwest corner stands the statue just erected to the memory of Rochambeau. It is a significant circumstance that of all the many statues that now adorn the capital city of the United States, there are none, not even of domestic heroes, which are so closely positioned to the home of the Chief Executive of the United States.

Count Rochambeau was born in Vendome, July 1, 1725, and died at Thoré, near that city, May 10, 1807. He entered the French army in 1742 and distinguished himself in various campaigns, reaching the rank of lieutenant-general. In 1780 he was placed in command of the French army sent to America. He embarked at Brest, May 2, 1780, under the escort of Chevalier de Ternay with five ships of the line, and in 1781 he actively co-operated with Washington in the movements which led to the capitulation of Cornwallis at Yorktown. It is said to be an authenticated fact that just before the surrender of Cornwallis at Yorktown, Rochambeau advanced to Robert Morris, the financier of the Colonies, the sum of $20,000 out of the French war chest to pay the men under Washington and relieve their pressing necessities. In recognition of Rochambeau's services, Congress gave him a vote of thanks and presented him with two pieces of cannon captured from the English. On his return to France, in 1783, he was made Governor of Picardy and Artois, and in 1791 was made Marshal of France. Bonaparte also named him grand officer of the newly-created Legion of Honor and pensioned him. During the reign of terror Rochambeau was imprisoned, and only escaped the guillotine by the death of Robespierre.

The statue, which is in bronze and of heroic proportions, is the work of Ferdinand Hamar, the deaf-mute French sculptor, and is a replica of the one erected in France. L. Parent is the architect, and the stonework of the pedestal, which is of French limestone, is by Ferdinand Gaussen. Besides typifying the happy relation of the two peoples, it is a handsome addition to the statuary of the United States capital, graceful in design, artistically executed, and well placed. Its most salient feature is the figure of the general in the uniform of his rank and with arm outstretched in the attitude of command. A symbolic figure below typifies the sentiment and meaning of the monument. A female figure representing liberty, with drawn sword in one hand, extends protection over the American eagle, which as a young fledgling is posed in an attitude of defiance against attack. The left hand of the figure bears aloft the entwined flags of France and of the United States, and the prow of a ship in the background suggests the help from over the sea. Lower on the pedestal is displayed the shield of the United States, bearing the thirteen stars of the original Colonies.

In recognition of the dignity and importance of the event, France has sent her splendid battleship, the "Gaulois," whose formidable proportions and equipment are so well shown in the illustration. It is an interesting fact that this fine specimen of a modern warship was built at Brest, the very port from which Rochambeau embarked for America in 1780, and she is also the first French battleship of the first class to cross the Atlantic. This ship brought with her, as representatives of the army and navy of France, Vice-Admiral Fournier, Inspector-General of the Navy; Lieutenant-Colonel Meaux Saint Marc, orderly officer and personal representative of



Turret ship (steel). 3 screws. **Displacement,** 11,275 tons. **Length,** 385 feet 6 inches. **Beam,** 66 feet 6 inches. **Draught,** 27 feet 6 inches. **Indicated Horse Power,** 14,500. Built at Brest. Launched 1896. Cost $5,300,000. **Armor:** Belt, 15¾ inches; gun positions, 15¾ inches; deck plating, 3⅛ to 1⅛ inches. **Armament:** Four 12-inch guns; ten 5.5 R. F.; eight 3.9; sixteen 1.8; ten 1.4; eight machine guns. **Torpedo Tubes,** 6 (2 submerged). **Speed,** 18 knots. **Normal Coal Supply,** 680 tons. **Complement,** officers and men, 682.

THE VISITING FRENCH BATTLESHIP "GAULOIS," IN ATTENDANCE ON THE ROCHAMBEAU CELEBRATION.

President Loubet; General Brugère, Commander-in-Chief of the French Army, Vice-President of the Supreme Council of War and Inspector-General; General de Chalendar, Commander of the 14th Infantry Brigade; Lieutenant-Colonel Hermite, Commander of the 6th Battalion of Foot Artillery; Captain of Artillery Peuilloux de Saint Mars, and Captain of Cuirassiers Lasson, attached to the General Staff of the government at Paris. Representing civil life, and previously arrived in the passenger steamer "Touraine," were the present Count and Countess de Rochambeau; the present Count de Lafayette; M. Croisset, of the Faculty of Letters; M. Le Grave, Commissioner to the Louisiana Purchase Exposition; and other well-known civilians. In appreciation of the courtesy of the French government Secretary Moody assigned a special squadron from the United States Navy to meet and salute the incoming "Gaulois" and act as an escort of honor. This squadron consisted of the cruiser "Olympia," Rear-Admiral Higginson's flag-ship, and the battleships "Kearsarge" and "Alabama."

The ceremonies at the unveiling of the statue in Lafayette Square included the following programme: Invocation by Dr. Stafford; welcome by the President of the United States; unveiling of the statue by the Countess Rochambeau; music, "The Marseillaise," by the French Band; presentation of the sculptor, M. Hamar; remarks by the French Ambassador (in French); selection by the French Band; remarks by General Horace Porter, United States Ambassador to France; selection by the Marine Band; address by Senator Lodge; "Star-Spangled Banner," by the French Band; remarks by General Brugère; benediction by Bishop Satterlee.

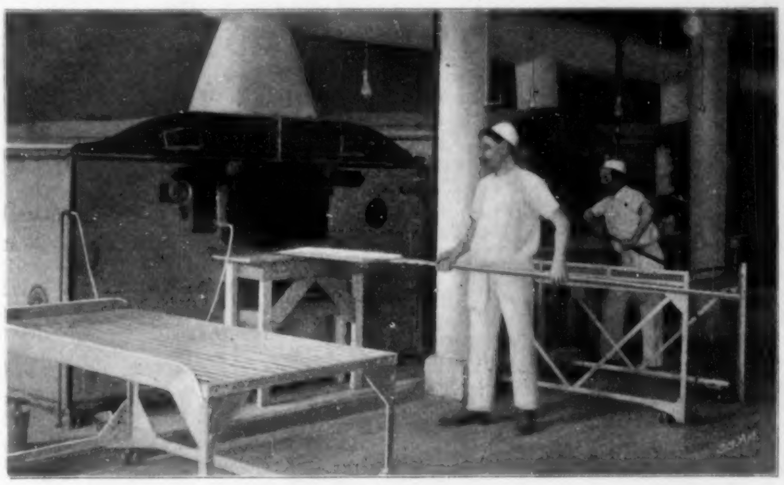
Following the ceremonies of the unveiling, social functions in entertainment of the guests will follow as a pleasant ending of the celebration. It is understood that the guests will visit various points of interest in the United States before returning to their native land.

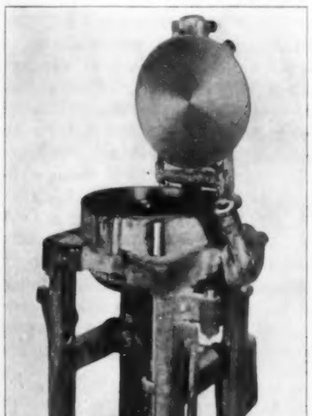
HYGIENIC MECHANICAL BREAD-MAKING.

The man who insists upon eating only the bread that his mother makes probably considers the loaf offered for sale in the grocery stores of the large cities the product of an uncleanly factory, and of the unwashed hands of men reeking with perspiration. Possibly that may have been true some ten years ago; probably it is still true of the little cellar bakery which supplies the bread of the people who live in the poor quarters of a large city such as New York. But home-made bread, good though it may be, has now been almost supplanted by the bread kneaded and baked by modern apparatus, especially designed for its purpose. Furthermore, machine-made bread has the one great merit over its domestic rival that it is absolutely uniform in quality. Each loaf is exactly like its fellow. The ingredients are always the same. The dough is always allowed to "raise" at a constant temperature. If in addition to its absolute uniformity, perfect cleanliness of production could be attained, there would be no reason for using home-made bread. It was the pleasure of one of the representatives of the SCIENTIFIC AMERICAN to inspect a plant installed at 262 West Broadway by the National Bread Company, of 25 Broad Street, New York city, in which bread is made by a system not only efficient, but so clean in its methods that it would meet with the approval of the most exacting physician.

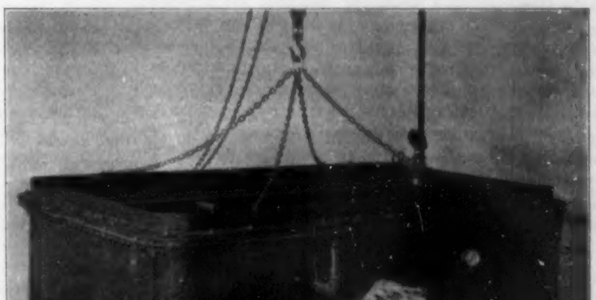
Briefly described, the process of making bread at this plant consists in mixing the various brands of flour—made from spring wheat, winter wheat, and pure rye—by means of a mechanical mixer and cleaner; conveying this mingled flour to a huge storage bin; transferring the flour to scales, by which it is automatically weighed and discharged into machines by which it is kneaded into dough with the necessary quantity of water; auto-

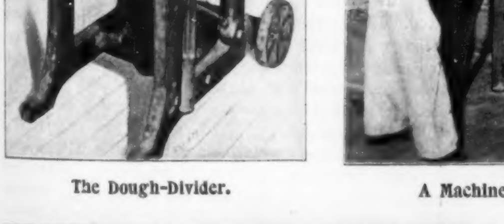

A Kneading Machine, Showing Mechanism.


In the Baking-Room.


The Dough-Divider.


A Machine That Forms Dough Into Loaves


Crustless Bread Oven.


Flour Mixer and Cleaner.


Machines For Mixing and Kneading the Dough.

HYGIENIC MECHANICAL BREAD-MAKING.

matically removing the kneaded dough from the machines and allowing it to raise in a steam-heated room; dividing the dough into sections and molding it into the desired shape; and finally baking the dough into bread. From this brief statement of the essentials of the processes carried out it does not appear that any wonderful efficiency is gained, or that any unusual cleanliness is observed. But a closer examination of the process will throw more light upon these important points.

Every man who works in this plant must be a surgically clean man. Before he starts his day's work he must bathe himself in one of the factory bathrooms; he must discard his own clothing and wear that which is supplied by the company. The clothing thus supplied consists not simply of trousers and jacket, but of a complete suit of underwear, down to a clean pair of socks. Not before he has clothed himself in a clean working suit, spotlessly white, is a man allowed to enter a working room. Surely a system which exacts the utmost cleanliness of its workers should produce a product which can be fearlessly eaten even by the man whose diet in large part consists of the bread that his mother makes.

In the making of this hygienic bread the first step is to mix and clean the flour. These two duties are performed by a machine of most wonderful operation. The machine in question takes the spring and winter flour, mixes them together, and so thoroughly refines them that even the finest fibers of the sack are removed and discharged into a refuse receptacle. Modern milling machinery has done much to improve the quality and cleanliness of flour before it reaches the consumer; but before it can be kneaded into dough and baked into bread it must be still further cleaned. That is why so elaborate a machine is required.

From this mixing and cleaning machine the flour is transferred by screw conveyers to a large storage bin. From the bin a second system of conveyers carries the cleaned flour to automatic scales, by which a certain quantity of flour is automatically weighed and discharged into the kneading and mixing machines. Yeast and other materials and filtered water of a certain temperature are added to the weighed flour in the desired quantities.

By far the most important and interesting feature of this bread-making plant are these kneading and mixing machines. It is their purpose to knead the dough exactly as it is kneaded by human fingers; but human fingers could never knead so thoroughly and so quickly, nor could they produce as many pounds of bread from a barrel of flour as these machines can. The main elements of a kneading machine are a wooden trough, above the bottom of which two screw conveyers are longitudinally mounted; and two reciprocating frames carrying wooden plungers inclined toward each other and arranged to play between the screw conveyers. The frames are connected by rods with two meshing gear wheels driven by a countershaft. The screw conveyers are rotated by the same means. The operation of such a machine is a rare sight. The screw conveyers, rotating in opposite directions, force the dough to the center of the trough; the oppositely rotating gears, through the medium of the connecting rods, cause the plunger frames to move up and down alternately, and the wooden plungers as they rise and fall intermingle the particles of gluten forced toward them by the conveyers. After thirty minutes of mixing and kneading, by which the flour, water, yeast, etc., are intimately commingled into a perfectly homogeneous mass, a trap door in the lower part of the machine is opened and the dough is automatically transferred to a wooden trough. It is conveyed to the steam-heated raising room. The trap door is then closed, new materials are put in the machine and another lot of dough is mixed and kneaded. There was once a time when all this kneading and mixing was done by hand. Not only is it hard to knead dough manually, but the flour is not economically used. By using mechanical kneaders, the dough can be mixed and thoroughly kneaded without touching it with the hands. The ordinary mechanical mixer produces about 285 pounds of bread from a barrel of flour. That is undoubtedly a very good result. But the peculiar kneader which we have described does better. Its average production is 350 to 352 pounds of bread per barrel of flour. Its record is 288 pounds. This economy and efficiency is due entirely to the peculiar kneading of the dough. The ordinary mechanical mixer usually effects a mixing of the flour, water, yeast, etc., by means of a double spiral dasher. There is no attempt to reproduce mechanically the kneading action of the fingers. In the machine under discussion, the kneading parts are mechanical facsimiles of the housewife's fingers.

After the dough has fermented or "raised," as it is popularly called, in the steam-heated room previously referred to, it is ready for the molder. Unfortunately no machine has ever been invented which is capable of giving to the dough any desired form. For that reason it is necessary to employ, even in this factory, men whose duty it is to mold the dough into the proper shape. But, despite this necessity, an attempt has been made to introduce a mechanical former. This machine consists simply of a number of rolls by which the dough is taken and curled and curled until it is discharged in the shape of a rather long cylindrical loaf. The machine does its work well. In the future we may even hope to see similar machines which will produce the usual cottage and twist loaves, as well as the other forms.

From the kneading and mixing room the fermented dough is dropped through chutes to the molding tables on the floor below. There the men divide it into small parts, and deftly knead it into the form in which it is to be baked. For some kinds of bread it is necessary to cut the dough into a number of very small parts. For this purpose a very ingenious divider is employed, which consists of a plate through which knives may pass vertically. The dough is laid upon the plate; a cover is swung down; a lever is pulled; the knives rise and the dough is cut into thirty-six parts. No matter what the quantity of dough may be, the number of parts into which it is cut will always be thirty-six. Moreover, the division is so clean that none of the parts cling to each other.

After having been molded into loaves the dough is allowed to raise for a short time, and it is then ready for the baking ovens. In the plant under consideration the design of the ovens conforms in purpose with the apparatus used in other parts of the plant. The comfort of the bakers and cleanliness of the bread are the main ends which it has been sought to attain. The old baking ovens are fired from the front. Coal is shoveled into a firebox which is placed directly beneath the baking tiers. Ashes are removed through the same opening. Naturally such a system presents a most excellent opportunity for the mingling of cinders with the dough. Such an objection has been overcome in the National bread plant by firing the ovens not from the front, but from the back. It therefore follows that the men can work at their ease, and that there is little or no possibility of baking bread in which a goodly portion of coal dust has been mingled. In order that the baker may see how his bread is baking, electric incandescent lights are used, which illuminate the interior of the oven. In order that a wonderfully tempting nut-brown color may be produced, steam is introduced into the oven during the baking process. After the baking the loaves are removed from the oven by means of long wooden shovels called "peels." They are then collected, classified as it were, sent to the shipping room, wrapped in paraffine paper and then loaded on delivery wagons.

In concluding this article attention should be called to an apparatus the like of which is probably not to be found in any other bread-making plant. The apparatus in question is intended for the baking of Boston brown bread and of crustless bread. It is a rather fashionable practice in serving sandwiches to cut the pieces of bread in triangular form and to trim off the crust. No doubt very dainty sandwiches are thus made. But the loss of good bread is considerable. In order to prevent this loss the National Bread Company has devised a steam oven in which bread which is absolutely without crust is produced. The dough is prepared in the usual manner, and is not baked by direct exposure to the intense heat of a fire, but is steam heated in a completely closed tin box. The steam from which the necessary heat is derived is the exhaust steam of the plant. The heat thus generated may be therefore said to cost practically nothing. And the result of this peculiar steam-baked dough is a bread which is a unique product of the modern baker. The same process is used in the baking of Boston brown bread. The dough is merely inclosed in cans and subjected to the baking heat of this exhaust steam. That crustless bread oven and the kneading machine may well be considered as two of the most interesting mechanical contrivances of this hygienic bread-making plant.

The company has under construction a scaling machine by means of which the dough can be cut into pieces of identical weight, each piece being sufficient for one loaf. It is expected that this machine will be ready for the bakery within a few weeks. When it is installed the entire operations from cleaning of the flour to the baking of the bread will be practically automatic, so that the human hand will not come in contact with the flour, dough or bread at any stage of the manufacture.

Trials of the Submarine Boat "Adder."

The submarine boat "Adder" had her trial trip on May 18. The trial is particularly noteworthy for the fact that it is the first time that a submarine boat has been operated in fresh water. The longest of the "Adder's" submerged runs was about 1½ miles; several of them were fully a mile long. In order to show that the vessel could be as easily handled in fresh as in salt water, a number of short or porpoise dives were made.

Engineering Notes.

According to the Railway and Locomotive Engineer, the first charter ever granted in this country, or probably any other, for the building of a railroad, bears date 1819. The Pennsylvania Legislature granted the charter in question to Henry Drinker, for a railroad from Delaware Valley to the headwaters of the Lehigh River—practically the route now controlled by the D., L. & W. Railway from the Water Gap to Scranton. That was before the days of steam, and the "wagons" that were to be run on the road were simply horse vehicles. The old charter, and the rights it conveyed, were purchased by the original Delaware & Lackawanna Company for $1,000.

There is every reason to believe that the great rush of German iron and steel not only into British and continental markets, but even into America, is prompted by financial necessities, remarks the Glasgow Herald. The country is suffering from the effects of enormous and unhealthy overgrowth. Production has been lately reduced by the force of circumstances, as the number of unemployed reveals, but it is still in excess of normal requirements. The surplus is still evidently so great that the only conclusion one can come to is that many concerns are being run merely for the purpose of "raising the wind." It is certain that most of the reported transactions in German iron and steel in foreign markets must be made at a heavy loss on the cost of production. For instance, a sale reported a day or two ago of 30,000 tons of hematite pig iron for America at 55s. f. o. b. Rotterdam is at a price 2s. per ton under Cumberland hematite. Yet the German stuff, made from imported ore, doubtless has to be brought some hundreds of miles from the furnaces to the port of shipment. Coal has lately been taken from Scotland to Stettin, there to smelt iron which was brought back to Scotland. All this means a losing business.

The locomotive industry of Austria comprises five different establishments, employing 5,200 workmen, viz.: The machine works at Florisdorf, with 1,300 men; the machine shops of the State Railway Company at Vienna, with 1,300 men; the locomotive works at Wienerenstadt, with 1,400 men; the Kraus Machine Factory at Vienna, with from 400 to 500 men; and the Bohemian-Moravian Locomotive Works at Prague, with 800 men, says The Railroad Gazette. The total number of men employed in normal times is about 6,000. The total annual capacity of the five establishments is about 400 locomotives, and their annual earnings are between $4,060,000 and $5,075,000. The various establishments have at present orders for 92 locomotives and 24 tenders from the State, and for some 20 locomotives from railroad corporations doing business in Austria. Foreign orders were quite frequent in former years, and even as late as 1900 no less than 60 Austrian-built machines went to Belgium and France. During the present year, however, the only foreign order received has been one from Egypt for six locomotives. Unless new contracts are obtained in the near future, four of the five locomotive-building establishments will be without work within six months. In fact, the blacksmiths and turners will be left idle much sooner.

The accumulation of amalgam on copper plates, like other mill matters, is largely resultant from the ore treated. In the case of some sulphide ores the amalgam has a tendency to form hard scale on the plates, which cannot be removed with a rubber scraper, whisk broom or any such tool, says the Mining and Scientific Press. But with a steel scraper the scale can be broken through and cracked off like a layer of dry putty, and this, if done properly, leaves the plate with a soft and satiny amalgam surface, if anything, better for catching gold, than the uneven surface of harder-scaled amalgam. The use of the steel scraper is necessary with inside plates, where the scouring of the heavy mineralized pulp seems to harden all the amalgam. Amalgam which forms hard scale on the plates yields bullion finer in gold and lower in silver than the softer variety, and it is generally obtained from ores carrying comparatively coarse or flaky gold. Possibly only the coarser gold tends to form hard amalgam scale on copper plates, so that while in some ore the native silver is the coarser, in other instances, where native silver is almost unknown, scale can only form from ores carrying coarse gold. The increasing proportion of silver to gold in the amalgam caught farthest from the battery is of common occurrence. The old plates should be thoroughly scoured for several hours with sharp sand from the tailings, hot water and quicksilver. The loosened amalgam could then be removed (after washing off the sand with hot water) with a rubber scraper in the ordinary way, leaving the plate with a good, soft surface of amalgam, in excellent condition for further use. Considerable difference lies in the mode of cleaning the plates, and especially in the use of the steel scraper. This tool can be used so as to ruin any plate, but in proper hands it is indispensable to the millman.

SINKING THE CAISSONS FOR EAST RIVER BRIDGE NO. 3.

The new East River Bridge No. 3, which will span the river between the present Brooklyn Bridge and the new East River Bridge No. 2, which is nearing completion, crosses from the foot of Washington Street, Brooklyn, to the foot of Pike's Slip, Manhattan. It will have a total length between anchorages of 3,165 feet, and a span from center to center of towers of 1,465 feet. The floor will be carried by four steel cables, and like the new East River Bridge referred to, its towers will be built of steel. As originally planned, the floor of the bridge was to have a total width of 120 feet, or 2 feet more than the floor of the new East River Bridge, and provision will be made for a large number of trolley tracks, as well as for two lines to connect with the elevated railroad system. The plans which are under consideration by the Bridge Commissioner contemplate track connections with both the Brooklyn Bridge and the new East River Bridge, and a circulating system of traffic, by which cars can cross by one bridge and return by some other, thereby avoiding the congestion which would occur if the railroads terminated at the bridge entrances, a congestion which is painfully evident every night and morning at the Manhattan end of the Brooklyn Bridge.

In the present article we describe the important work of sinking the caissons which form the foundations of the towers for the new bridge. The caissons for the new East River Bridge No. 2 were four in number, there being two beneath each tower. This arrangement was necessitated by the rather steep slope of the underlying rock at the site of the towers of that bridge on each side of the river; but fortunately the preliminary borings for Bridge No. 3 showed that the surface of the underlying rock was fairly level, and hence it was decided to construct a single huge caisson to form the foundation under each tower.

Our front page illustration shows the process of sinking the Brooklyn caisson, which is located immediately at the foot of Washington Street. The structure measures 78 feet in the direction of the axis of the bridge by 144 feet transversely to the axis. The caisson proper is 55 feet 6 inches in depth, and above this is a temporary cofferdam 44 feet in height, which is built up to prevent the water from flowing into the work during sinking. It will thus be seen that the total depth of this huge box, when it is finally sunk to bedrock, will be just 6 inches short of 100 feet. The walls of the caisson are built up of two layers of 12 x 12-inch timber, the outer one laid horizontally and the inner vertically, while on the outside of this is a double layer of 2-inch planking, the inner laid diagonally, and the outer vertically, as shown in our engraving. The planking is calked to make it perfectly watertight. The bottom edge of the caisson is shod with a half-inch steel plate to protect it from injury as it is forced downward through the silt and sand. Six feet from the bottom edge there is built over the whole caisson a solid roof of timber 2 feet 9 inches in thickness. The space beneath this watertight roof is known as the working chamber, and here are employed the "groundhogs," as the men who are engaged in the work of excavating are called. This working chamber is divided into three longitudinal sections, from which to the surface of the cofferdam there extend nine plate-steel material shafts and one elevator shaft, both material and elevator shafts being furnished with air locks. There are also fourteen 4-inch wrought-iron pipes which extend, like the shafts, from the roof of the working chamber to the surface. At the bottom of each of these pipes is a flexible hose similar to the section hose of a fire engine. At the top of the pipes there are bends which pass over the edge of the cofferdam and discharge into the river. Under the old system of building caissons, it was customary to build the roof of solid timber to a thickness of some 10 or 12 feet; but in the present case the roof is made of the same thickness as the side walls, namely, 2 feet 9 inches, and the necessary strength is secured by building a cofferdam of 12 x 12-inch timbers, which for the first 25 feet above the roof are laid on 12-inch centers vertically and for the next 15 feet of the height are laid on 2-foot centers vertically, the lateral distance between centers being 6 feet. This mass of cribwork is stiffened vertically and laterally by a perfect forest of diagonal trussing, the great depth of this trussed cribwork serving to give a very powerful bridge effect in supporting the load upon the roof of the working chamber.

The caisson, which was built in the Harlem district, was towed down the East River to its site, and sunk to the river bed by loading it with concrete. The material for the concrete is brought by barges to each side of the pier at the foot of which the caisson is being sunk, and a couple of powerful derricks on the pier lift the sand, broken stone and cement, and empty it into a large concrete mixer on the pier. From the mixer the concrete is run through the bottom of a hopper into buckets, which are then picked up by other derricks and dumped into the caisson. The concrete falls among the cribwork and is rammed tight, filling all the interstices from the roof upward.

Under ordinary circumstances, in sinking a caisson the bulk of the material would be shoveled from the bottom of the river that is covered by the working chamber into buckets and then hauled up through the shafts and airlocks, and finally dumped into barges and carried away. But in the present case the material of the river bottom has been found to be such an almost pure sand, that the bucket shafts have been used but very little, and it has been found possible to blow out the materials by the force of the compressed air, which is forced into the working caisson for the use of the workmen. The method of blowing out the sand is as follows: The bottom of each of the 4-inch permanent pipes, which we spoke of above as being fixed in the caisson, has a length of hose which reaches from the roof of the working chamber to the bottom of the excavation. A 4-inch water pipe, which also passes through the caisson, supplies water at 100 pounds pressure to six jets. One of these jets is directed at the sand around each blowpipe, and loosens it so thoroughly that the air pressure in the caisson is sufficient to blow it up through the pipe and out over the edge of the caisson. Thus far practically the whole of the excavation has been done by this method, but very few bowlders and rocks being encountered. The cutting edge of the caisson reached the bed of the river at 20 feet below mean high water. Here it passed through 4 feet of mud, and then entered a deep bed of fine sand which the borings show to extend through a depth of 66 feet. Below this is about 4 feet of coarse gravel, and then is found the solid underlying rock on which the caisson will finally rest, the rock being found at 94 feet below mean high water, or 74 feet below the bed of the river. Considering the huge size of the caisson, the largest ever constructed, the speed of sinking has been remarkable. The work commenced on March 26, and at the present writing the caisson is about two-thirds down. The probability is that by the middle of June it will rest upon the rock bottom.

From what we have already said, it will be understood that the longer side of the caisson lies up and down stream, parallel to the shore. Our front page illustration is drawn looking downstream toward the Brooklyn Bridge, the easterly towers of which are visible in the distance. The side of the caisson is broken away in the drawing in two places for the purpose of showing the elevator shaft and the cage descending with workmen. The construction of the roof, walls and bulkheads of the caisson is also clearly shown, and in the working chamber a workman is seen directing a blowpipe hose against the loose material on the bed of the river. When the caisson has reached solid rock, the whole interior of the working chamber will be filled with tightly-rammed concrete up to the very roof, thus providing a solid concrete and timber mass from the rock level to the top of the caisson, which will be 37 feet below mean high water. The surface will be carefully leveled off, and upon it will be built a solid masonry pier, whose base will be 67 feet by 134½ feet, and whose coping will be 23 feet above mean high water, the total height of the masonry pier being 60 feet. We are indebted to Mr. F. M. Sylvester, the Resident Engineer in charge of the work, for courtesies extended in the preparation of this article.

The Current Supplement.

A large picture of what is perhaps the largest crane in the world constitutes the frontispiece of the current SUPPLEMENT, No. 1378. A full description of the crane is also published. A subject which should be of rare interest to engineers is the purification of feed-water. The article in which this matter is treated is very fully illustrated and very exhaustive. Dr. H. F. Keller discourses entertainingly on the gases of the atmosphere; and Dr. Stephen D. Peet tells something of ethnic styles in Central American architecture, illustrating his text by good pictures. Messrs. Swinburne and Cooper's paper on the "Development of Electric Railways," which has attracted such widespread attention among electrical engineers, is published in the current SUPPLEMENT. The recent Nice automobile races are described, and some of the vehicles that took part are illustrated. An article of timely interest is that on the unveiling of the Rochambeau statue, which is accompanied by a picture of the statue itself.

Iron Ore in Porto Rico.

Dr. David T. Day, Chief of the Division of Mineral Resources of the Geological Survey, returns from a trip to Porto Rico with accounts of the iron resources of the island. His superficial inspection rendered it difficult for him to ascertain how productive the ore beds might prove to be. But it seems certain that there is enough to warrant the growth of a fair-sized industry. Gold is not found in sufficient quantities to warrant a repetition of the Klondike excitement. At present about four hundred families are engaged in gold-mining. The product of their labor is carried to the stores, where it is weighed and given in exchange for food, clothing and cattle.

Automobile News.

In the recent speed trials organized by the Automobile Club over a kilometer course at Gunton Park the highest average speed for four runs was attained by a 50-horse power Napier carriage, which covered the distance at the rate of 44 miles per hour. A 24 horse power Mors car gave an average speed of 41 miles per hour. The road surface was heavy, and two runs were down hill and two up hill.

Emperor William is doing his best to promote the alcohol industry. He has induced the North German Lloyd and Hamburg-American lines to adopt, experimentally, spirit motors on their small harbor craft. It is said that the Krupps are about to order an eight horse power spirit motor for their station at Meppen. The Alcohol Association will supply the spirit for these experiments gratis. What the outcome of these experiments will be is hard to say. That alcohol ought to prove an admirable fuel is evident enough from the recent trials made in Paris and Berlin, but up to the present time no satisfactory alcohol motor has been invented. There is here a chance for inventors.

One of the latest men of prominence to testify to the usefulness of the automobile to a business man in the time saved going to and from his business is Mr. H. C. Frick, the well-known steel magnate of Pittsburg. Mr. Frick uses a powerful machine to cover the fourteen miles from his home to his office twice daily, and the time consumed in the journey is but twenty-one minutes. The millionaire is reported to have said the time saved him by the new means of locomotion amounts to at least half a million dollars yearly. At the present rate of improvement, it will not be long before the automobile will compete with the railroad over much greater distances, and the life of the cinder-begrimed commuter will be freshened by a rapid ride to business through the clear morning air from his country seat twenty-five to fifty miles away. Good roads are all that are needed to cause such prophecies to be realized.

An ingenious sparking plug, called the "Seer," has been devised, in which the usual porcelain core has been replaced by a glass thimble. The metal portion of the plug is of the standard pattern, and the glass can be adapted to existing plugs. As a means of viewing the spark while the plug is in place it has obvious advantages, for it is not always certain that a plug needs attention when one unscrews it to see. If the plug is so dirty that the spark cannot be seen through the glass, there is certainly occasion for cleaning, but the advantage of being able to view it from outside is emphasized by the fact that an external spark when the plug is dislodged does not occur under the same conditions as in actual use. The heat and the pressure are disturbing factors, and it is therefore a decided convenience to see that the plug is doing its work correctly. Tough glass, which is less fragile than porcelain, is used, and experiments have shown that the glass is less likely to get dirty than porcelain, probably owing to its higher degree of polish.

The automobile with which Messrs. Lehmess and Cudell have started from London to make a tour around the world, is of the Panhard & Levassor make, with a Centaur motor of 20 horse power, four-cylinder type, with four speeds and rear movement. To avoid breakdowns caused by the igniting apparatus they took three kinds with them: a gasoline burner, an auto-sparker and a third igniter fed by accumulators which they will charge from dynamos. The four wheels have equal diameters and the front wheels may be placed in the rear, being provided with bosses for attaching the chain-wheel. The reservoirs contain 150 gallons of petrol, 25 gallons of water and the same of oil. The weight of the six passengers and baggage is 6,600 pounds. The automobile carries also Mr. G. S. Harvey and Baron de Breyne, besides a mechanic and a cook. The party started from London on the 1st of May. They are to remain in Paris about ten days and will then start on their tour around the world. The route has been carefully studied. They will pass by Brussels and reach Berlin by way of Cologne and Magdeburg. Upon reaching Russian territory they will pass by Posen, Grodno and Wilna to St. Petersburg, which Dr. Lehmess counts upon reaching about the end of May. Then come Moscow, Nijni-Novgorod and finally Ischelbinsk in the Ural region. They will pass through Asia by way of Siberia, through Omsk and Irkoutsk, and traverse China by Urga, Kalgan and Pekin, thence embarking at Shanghai. They will have one stage in Japan, from Nagasaki to Tokio. After stopping at Honolulu they will embark for San Francisco and undertake the tour of America, passing by Mexico, New Orleans, St. Louis, Chicago and New York, after making a point as far as Canada. From New York they will sail for Southampton. The party expects to reach London in eight months, if all goes well. At Paris Mr. Cudell found one of his friends, Mr. O. Heymann, who is to accompany the party with a 12 horse power Ader machine and serve as scout along the road.

POMPEII.

With the long-drawn-out tragedy of the West Indian eruptions being now enacted before our very eyes, the parallel disaster that happened to the Roman seaside resort of Pompeii takes on an added interest, in spite of the interval of nigh upon two thousand years that has lapsed since the city was buried. The destruction of Pompeii differed from that of St. Pierre in that while the modern town was practically razed to the ground, the buildings of Pompeii were left standing, although they were buried entirely out of sight by the falling volcanic ashes.

There is no city in the antique world of which we know so much as Pompeii—a place whose sudden extinction was, perhaps, the most important event for Roman archæology which could have occurred. The literature on the subject is most extensive, and we have in one bibliography of the subject no less than five hundred titles.

Pompeii in the old days lay nearer the sea and the River Sarno than at present. It stood on an elevation a third of a mile from the sea, offering a charming spot for a sojourn or a permanent residence, so that it is little wonder that Pompeii was so popular with the Romans. We know very little of the city prior to its destruction except that the inhabitants engaged in commerce and agriculture, and did quite a business in millstones. At the time of the great eruption of 79 A. D., the population was a very mixed one.

In A. D. 63 the city was visited by a violent earthquake which threw down most of the buildings in the city, and there was just about time to rebuild the public buildings when the great catastrophe occurred. This was perhaps fortunate, because now we have the remains of the city built nearly all in one period. The damage was done by the volcanic ash and pumice made into a kind of muddy rain, combined with earthquake shocks. The woodwork of the buildings was not set on fire, but was so desiccated and charred that it has not been in most cases preserved. There is every indication that a copious rain fell with the ashes. It is estimated that 2,000 persons perished in the catastrophe. The city formed an irregular oval four-fifths of a mile long and two-fifths of a mile wide. It was surrounded by a wall and there were eight gates. The city took its shape from the end of the old lava stream in which it lay, which ran southeast from Vesuvius. Our engraving is from a model of Pompeii which gives a much better idea of the city than can be obtained in any other way. The visitor is supposed to be looking from the Stabian gate. The theater or colonnade, used as a barracks for gladiators, is on the left and is shown with the columns of the colonnade. Directly beyond, will be seen the termination of the triangular Forum, while in the center are two theaters known respectively as the Large Theater and the Small Theater. Back of the Large Theater is an open-air gymnasium and the Temple of Isis. The street which is so prominent an object is the Stabian Street. The streets were laid out with great regularity and the public buildings form two groups, one lying about the Forum and the other is the group which we have just described. The Forum measures 497 by 156 feet, including the colonnade. No vehicles of any kind were permitted in it, as is shown by the upright stones at the streets, which bar all passage to chariots or carts. Gates were provided, so that even pedestrians could be kept out if it was thought desirable. The Forum was given up to temples, markets and buildings connected with the administration of the city. The principal buildings were the Basilica, the Temple of Apollo, the Market Buildings, City Treasury, the Temple of Jupiter, the Sanctuary of the City Gods, the Temple of Vespasian and the Voting Place. The Baths of Pompeii were naturally on a small scale, but owing to their excellent preservation and the certainty with which the use of the various rooms can be assigned, we derive from them most of our information regarding the arrangements of ancient baths. The Amphitheater lies at a distance from the other excavations. Its length is 444 feet, breadth 342, and is small compared with other amphitheaters, but was naturally large for the town, so that only a part of it was provided with seats.

VIEW SHOWING THE PRESENT CONDITION OF THE EXCAVATED CITY OF POMPEII.

The houses of Pompeii are worthy of special study. They face the streets, which are usually the average width, being 10 to 20 feet. There were sidewalks with curbing and broad ruts were made by passing wheels. Only the principal streets were wide enough for two vehicles to pass.

CYNIPS POLYCERA.

BY M. C. FREDERICK.

CYNIPS POLYCERA.

No photograph nor description can portray the delicate beauty of the home of the young *Cynips polycera*. It was at the foot of the Santa Ynez mountains, across the range from Santa Barbara, that I saw them for the first time, depending from the under side of white oak leaves like fairy bells or tiny fantastic Japanese lanterns. In the midst of a natural park, consisting mostly of magnificent live oaks which have been jealously guarded from the woodman's ax that has almost denuded the region of timber, are a few stately white oak trees. They bear a bountiful crop annually of rosy-cheeked "oak apples;" but it was only on a white oak scrub that the remarkable *Cynips polycera* was found, the insect mother who provides so curiously for her prospective offspring, evidently selecting the tender, juicy, leaves of the young tree in preference to the less vigorous growth of the mature ones.

With a leaf for a canopy these brilliantly-colored and highly-ornamental homes are easily overlooked, but an observant eye once catching the gleam of the white-and-rose, so delightfully blended, follows up the discovery until a veritable wonderland is revealed.

As not even the tiniest opening is visible through which the occupant might have entered in its earliest infancy—not to mention the access of air and food—it is hard to believe these starlike fairy bells the habitations of living organisms.

How the little grub gets inside has long been an open secret of the student of natural history, who knows that the multitudinous variety of galls found on rose bushes and other vegetation, but chiefly upon the oaks, are caused by the sting of a little fly who lays her eggs in the soft tissues of leaf or stem.

The male of some kinds of gall flies has never been discovered, hence parthenogenesis is believed to meet this deficiency in nature. The female is provided with a hair-like ovipositor snugly coiled within the body except when in use, and then it is thrust into the soft under side of the leaf and forms a conduit through which the egg is embedded beneath the surface. It is believed that an irritating fluid is also injected into the puncture which causes the strange growth known as a gall and within which the egg is hatched and the larva lives until ready to emerge into the world, when it bores its way out. How the beautiful colors originate when they are no part of the life of the tree, and what part they play in the economy of gall-fly life, no one has yet told us.

The cradle of the *Cynips polycera* has but small attachment to the leaf but spreads into a bell-shaped form, the broad end usually flat, and the rim serrated by the horn-like projections from which it takes its name. In substance it is soft and juicy like apple, quickly shriveling if the branch is detached from the

tree. Unlike many parasitic growths the cynips do not seem to interfere with the health of the leaves or plants, those so studded being quite as thrifty in appearance as the others.

RAILROADS IN CUBA.

BY WALDON FAWCETT.

The railway systems, existent and prospective, in the Island of Cuba constitute one of the most important factors in the promised development of the new republic. To a neglect in the past to comprehend the full value of transportation facilities must be attributed, in a measure, the retardation of the commercial and industrial advance of the country; but nevertheless the dawn of the new era in Cuba has found ready to hand a very fair foundation equipment of rail lines, steam or electrically operated. Moreover, the inauguration of American military control was coincident with the promulgation of an enterprise for the construction of a great trunk line through the center of the island—a long-awaited and sorely needed undertaking of pre-eminent importance; and finally, other projects of only slightly lesser importance but awaited the establishment of a stable government to take definite shape.


Raising the Tracks at Jucaro.


Masonry Piers for Bridge Across Guaninicum River.


Pile Trestle Bridge on the Eastern Division.


Railway Headquarters at Ciego.

RAILROAD CONSTRUCTION IN CUBA.

The railroads of Cuba are divided into two general classes: the public railways and the private or plantation railways, the latter being designed, of course for marketing the products and aiding in the distribution of supplies on the large estates on the island. The public railways comprise seventeen separate systems, although nearly all are owned and operated by five companies, and their aggregate length is in the neighborhood of 1,225 miles. There are 107 plantation or private systems totaling 872 miles in length, and thus the total railway mileage amounts to 2,097 miles.

In view of the fact that these lines have been built in a tropical island, where it is necessary to exercise great care in the construction of tracks and bridges that they may withstand the exactions of the rainy seasons when water in torrents descends upon the road-beds, the cost of construction constitutes an interesting phase in their history. The 124 railroads of all kinds represent a cost of $68,474,407 in gold. Of this sum $57,164,715 was expended for the public railways and $11,309,692 for the private lines. Two of the public railroads have been operated at a slight loss for some time past; but all the others have proven profitable in a greater or less degree. During the last calendar year for which the operating companies have submitted statements the profits of all the lines, if pooled, would have amounted to about $2,120,000. The existing railways in Cuba are owned largely by British capitalists and the headquarters for a majority of the various operating companies are in London.

In order to convey an idea of the conditions obtaining in the case of a thoroughly representative Cuban railroad, it may be well to direct momentary attention to the Puerto Principe and Nuevitas Railroad, one of the oldest and best-paying lines on the island. The line extends from the seaport of Nuevitas for a distance of 45 miles to the important inland city of Puerto Principe, through a level region principally adapted to cattle raising, but in which a number of large sugar plantations are situated. One of the reasons why this system constitutes so valuable a property is that it has no bonded indebtedness and pays handsome dividends to its few shareholders—it being a close corporation, composed of less than a dozen stockholders.

The operating company is virtually a private corporation, with a capital stock of $1,000,000 and eight stockholders, each of whom holds one share of stock. The government and administration of the affairs of the company are in charge of a committee composed of three stockholders, elected annually by the others by a plurality of votes and who are not eligible to reelection. They perform their duties gratuitously. The line has twenty bridges and seven pontoons with walls and pillars of masonry and trusses of steel and a large number of culverts also of masonry. The stations are of lumber and tile, and the rails are of American steel, weighing fifty-six pounds a yard. The rolling stock consists of five passenger and five freight locomotives, the heaviest weighing sixty tons, eleven passenger coaches and 137 freight cars. The telegraph line in connection with this system was constructed in co-operation with the Spanish government, the cost being shared equally. There are two wires extending the entire length of the road, the upper wire being for government use and the lower for the use of the railroad company.

Several of the smaller and less important railway lines in Cuba belong to the new government as an inheritance from Spanish sovereignty. One of these, the Jucaro-Moron system, cost the Spanish government $1,152,800 in gold. Private parties are willing to purchase at least one of these railroads, reimbursing the government for the full amount of the first cost, and it is probable that ultimately all the lines under governmental control will be either sold or leased to private corporations, following the example of the Mexican government, which, after expending millions of dollars on the Tehuantepec Railroad, finally leased it to an English firm.

As indicative of the equipment available for the development of the mineral resources of Cuba it may be noted that several of the corporations operating iron mines on the island control their own rail lines. This is the case with the Spanish-American Iron Company, the Juragua Iron Company, the Cuban Steel Ore Company and the Sigua Iron Company. The Spanish-American Iron Company owns five freight locomotives and sixty ore cars and has transported as high as 30,000 tons of iron ore a month.

The deepest interest in the Cuban railway field naturally centers in the new operations having for their object the extension of the transportation facilities of the island. Prominent among these is the project of the Havana Electric Railway Company, which has undertaken to reconstruct and extend the street railway system of Havana, giving the Cuban metropolis a thoroughly modern urban system. The new 7-inch girder rail weighs ninety pounds per yard; the steel ties are spaced every ten feet, and the roadbed is of concrete 7½ inches thick, with vitrified brick and asphalt block paving. When completed there will be thirty-six miles of single track, and the cost of reconstruction will exceed $3,000,000. There will be 110 motor cars with two 25 horse power motors on each car, and the power house will represent when all machinery is in place an investment of about $480,000.

However, the enterprise of supreme importance in the transportation field, if not indeed in the entire range of activities on the island, is found in the project being carried out by Sir William Van Horne, the builder of the Canadian Pacific Railroad, and the capitalists associated with him in the construction of a central line of railroad throughout the length of the island. This "backbone railway," as it has been aptly termed, and which will exert a more powerful influence for the general development of the island and all its resources than any other one undertaking, was an objective institution with foreign capitalists for half a century prior to the Spanish-American war; but all their schemes failed of consummation. The main line from Santa Clara to Santiago, to be completed this spring, is about 350 miles in length; but there will be feeders to the north and south coasts which will bring the aggregate length of the system to approximately 1,000 miles. The branches or

feeders will reach such ports as Nipe, Baracoa, Gibara and Manzanillo, connecting them with the interior and affording an outlet to deep water shipping points for the plantations along the lines.

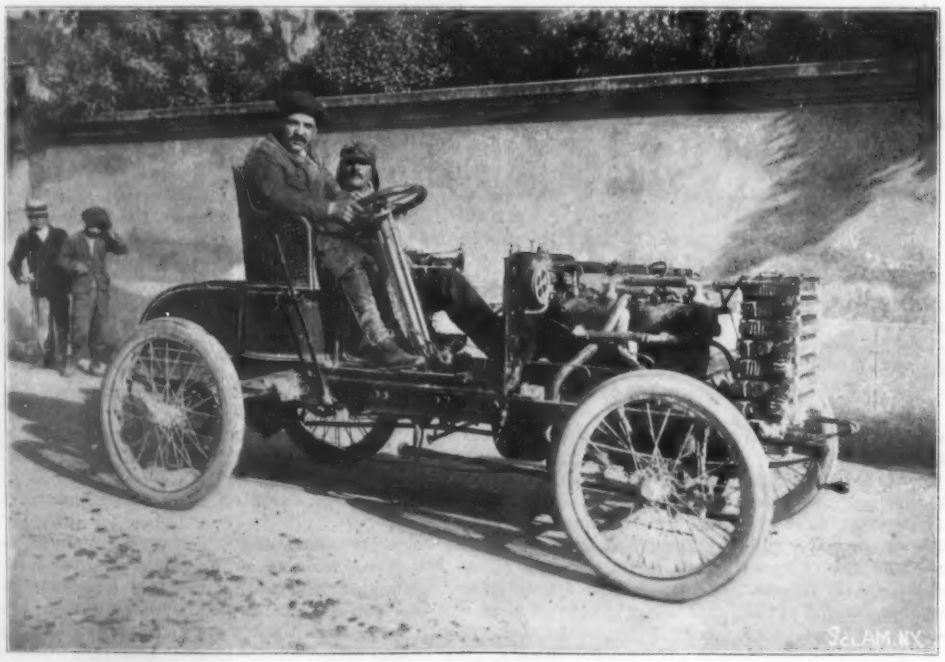
The Cuba Company, as the Van Horne syndicate is known, has carried on its construction work in the face of many difficulties, not the least of which was found in an inability to secure a governmental franchise or even a permit for construction, and the consequent necessity of purchasing outright a private right of way. However, the same energetic tactics which characterized the construction of the Canadian Pacific Railroad were adopted, a working force which at times exceeded 6,000 men was employed, and at certain portions of the route the line was carried forward at a rate considerably in excess of a mile a day. The construction of this new railroad has been thoroughly in accord with the latest approved modern practice in every respect. Although it has been necessary to provide an immense number of bridges, owing to the volume of water which falls during the rainy season, steel construction has been employed exclusively, and the rolling stock and equipment is identical with that to be found on the most important railroads in the United States.

THE NICE-TURBIE RACE.

BY OUR PARIS CORRESPONDENT.

After the suppression of the Nice-Abbazia race, which was to have been the main event of the season at Nice, the chauffeurs had to fall back on the Nice-Turbie hill-climb and the Rothschild Cup to try their new racing machines which had cost so much labor in the preparation. The Turbie hill-climb is a severe test for the machines in more ways than one. The road starts from Nice and winds up the mountain side to the village of La Turbie, situated at the summit. Not only is the grade very steep but the route is unprotected by curbing on the outer side and is on this account quite dangerous. Several racing-cars met with accidents here, and one was smashed to pieces; however, no one was seriously hurt. The race took place in a heavy fog, which was a disadvantage, as it prevented the racers from making their best time. At the top were assembled a large party of chauffeurs about the chronometer station. The heavy-weight caravan had already climbed up the slope and the vehicles were drawn up in line to await the finish before descending to Monte Carlo. The start was chronometered by M. Tampier and the racers started at 3-minute intervals. The record was made by Mr. Stead on a 40-horse power Mercedes machine, which covered the distance of 15.5 kilometers (9.6 miles) in 16 min. 37 3-5 sec. Next came Gabriel on a 30-horse power Darracq, in 16 min. 50 3-5 sec. One of the engravings shows the Mercedes racing machine, mounted by Mr. Stead and in the second will be seen Gabriel in his light weight racer. The Mercedes and Darracq machines carried off the honors of the race, as three of the former made the best time in the automobile class, and six of the latter came first in the light vehicle class. Osmont, on a De Dion motocycle, held a very good place. The Mercedes machines are built at the Daimler works at Canstatt (Alsace), and these powerful racers continue to be formidable competitors to the French machines. The same holds good in the heavy weight class, where a Daimler hauling wagon made one of the best records in the Paris-Nice concourse. At La Turbie was noted a novel type of electric automobile made by Lohner & Porsche, of Vienna, which will be described later.

40-Horse Power Mercedes Machine (Daimler System)—Winner in Automobile Class.

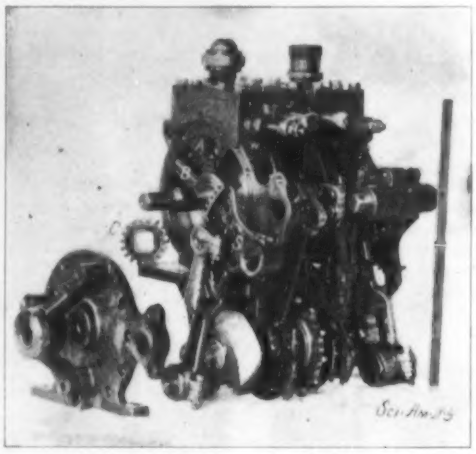


30-Horse Power Darracq Machine—Winner in Light Vehicle Class.

NICE-TURBIE HILL-CLIMBING CONTEST.

AN OSCILLATING COMPOUND STEAM ENGINE OF NOVEL DESIGN.

The compactness of the engine shown below is readily seen by comparing it with the foot rule standing beside it. Occupying as it does, less than one cubic foot, it nevertheless has abundant power to pull a 1,000-pound automobile out of a mud hole or send it quickly up a steep ascent; for although normally the engine develops but 4 horse power, by a simple changing of valves accomplished instantly by the movement of a special handle, the cylinders may both be made to take high pressure steam, thus more than doubling the power and enabling the engine to develop 9 horse power.



THE STOWELL OSCILLATING COMPOUND STEAM CARRIAGE ENGINE.

The illustration shows plainly the piston and cylinder construction. The engine is built on similar lines to most rotary engines as far as these parts are concerned. The piston consists of a flat blade, *B*, secured to the shaft and adapted to oscillate between the faces of the abutment, *A*, through five-sixths of a revolution. The steam enters through ports in the abutment not shown in the cut, which direct the jet upon the outer end of the blade, thus obtaining the greatest leverage possible from the initial pressure. The inlet and outlet of the steam is controlled through ordinary slide-valves, links and eccentrics. A special packing is employed on the valve stems, which causes little or no wear and assures a tight joint. The engine is protected against steam leakage at all points where such leakage could possibly occur, by spring-pressed metal packing strips. The blade, *B*, has two pairs of L-shaped packing strips, spring-pressed both sidewise and endwise; the abutment, *A*, holds a packing-strip in its lower face, which is pressed downward against the shaft; and two rings on the ends of the latter within the cylinder, make a tight joint between it and the cylinder walls. It will be seen, therefore, that steam leakage is effectually guarded against, even after the engine has been in use for some time and the parts have become worn.

The long stroke—8 inches—obtained in this engine is one of the main points gained by the use of the rotative principle followed in its design. It will be observed, also, that with this construction the amount of steam required to fill the exceedingly short ports is greatly reduced as compared with other slide valve engines of corresponding length of stroke, and the waste of steam is thus brought to a minimum. The 8-inch stroke of the piston is reduced to a 3-inch stroke on the crankshaft by means of the pinion, *C*, and segment, *S*, which are made of harveyized steel and phosphor bronze respectively. The pinion, as is seen is squared on the shaft, while the segment and connecting rod are heavy and substantial, and abundantly able to transmit the power for which they were designed. Suitable counterweights on the cranks balance the piston, connecting-rods and segments. The segments are pivoted on eccentric studs so that any wear of the gears may be taken up. The low-pressure cylinder is of the same diameter as the high-pressure one—5 inches—but is twice as wide, having a cross-section of 2 inches. The steam exhausts from the high pressure cylinder through the large hole in the center of abutment, *A*, whence it passes to the low-pressure cylinder. By means of the afore-mentioned transforming device for which patents are now pending, the low pressure cylinder is instantly available for high-pressure steam by a simple turn of a handle, thus giving a steam carriage equipped with this engine an advantage similar to that employed by using two gears, without the corresponding complications.

The compactness of the engine is such that it can be completely housed in the carriage body; and while on the road, should it be necessary to take it apart for examination or repair, the entire crank-

shaft, connecting-rods, segments, eccentrics, etc., can be removed at one stroke, by loosening the eight cap-screws in the main bearings and removing the eccentric bearing pins of the segment and the pins upon which the links slide—less than a dozen nuts and screws in all.

The engine is the invention of Mr. B. F. Stowell, of Springfield, Mass., and is at present being manufactured by the Waltham Watch Tool Company, of that city. It has been given some severe tests as to its strength, power, economy, and wearing qualities, and has demonstrated its efficiency in these respects. The manufacturers, in introducing it, are confident that it will fill a long-felt want for a substantial, economical, and simple steam motor for automobiles and all light power purposes, and they believe the principle to be equally well adapted to engines for heavy service.

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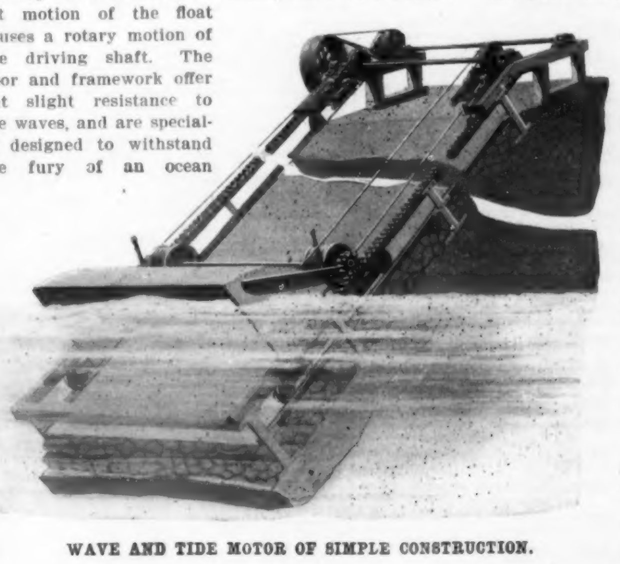
WAVE AND TIDE MOTOR.

Man's progress toward utilizing the wonderful power of the ocean should be followed by the public with great interest; for the energy stored up by the motion of tides and waves is being used increasingly for operating machinery. Most wave motors are worked by the striking power of the waves. We show here a motor which is designed not only to utilize the impact of the water, but also its buoyant power, thus making use of the rise and fall of tides. The motor is mounted on a foundation situated at the water's edge and consisting of a smooth inclined floor. A float is arranged to slide up the incline under the action of the waves and to return by gravity, it being mounted on wheels which travel between guide rails on the framework at each side. In order to transmit the up-and-down motion of the float to a main shaft, the following device is provided: Cables are fastened at one end of the float and, passing over pulleys at the top of the incline, are brought back and secured to drums on the float. As the float moves up or down the incline, the cables are wound on the drums by the rotation of pinions which are secured to the drum shaft and which engage the racks on the framework at each side. As the cables are wound up, they cause the pulleys at the top of the incline to rotate first in one direction and then in the other, according to the travel of the float. In order to compensate for the expansion and contraction of the cables, they are made to pass over loose pulleys mounted in suitable guideways on the side frames. Weights are hung to these pulleys and draw them downward, thus maintaining a constant tension on the cables. In order to utilize the power thus far gained, it is necessary to transmit the alternating rotation to a driving shaft traveling in one direction only. To this end two pulleys are secured to one end of the pulley shaft and connected by belts to pulleys on the driving shafts, one of the belts being crossed. The latter pulleys are so connected by pawl and ratchet mechanisms to the driving shafts that first one and then the other will act to drive the shafts in a single direction. A flywheel may be attached to the shaft to steady the rotary motion. If desired any number of floats may be connected to a line of shafting, each transmitting power independently. It will be seen that by this construction a maximum power is obtained; for not only the impact of the waves is utilized, but even the slightest motion of the float causes a rotary motion of the driving shaft. The floor and framework offer but slight resistance to the waves, and are specially designed to withstand the fury of an ocean storm—a vital point in the construction of all wave motors. Mr. W. Bochert, of Carson City, Nev., is the inventor of this motor.



WAVE AND TIDE MOTOR OF SIMPLE CONSTRUCTION.

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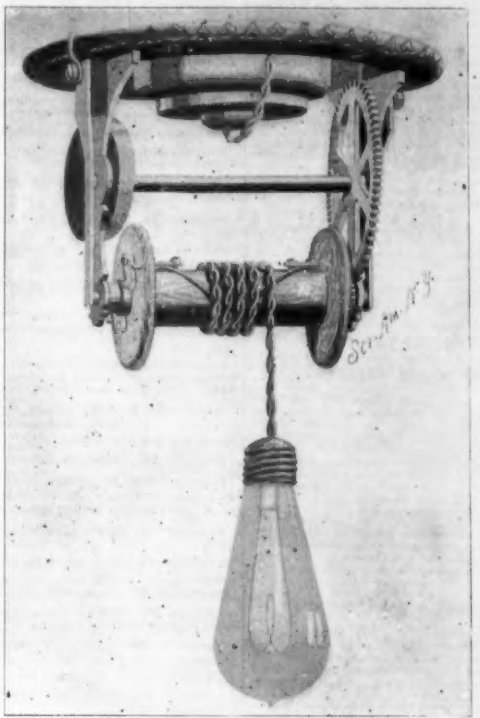
An Austrian millionaire named Darcy is said to have obtained a concession to work the oil belt in southwest Persia. Surveying has begun for a pipe line 360 miles long from the Kerkah Valley to Mohammerah. The oil is believed to be purer than the Russian and to be abundant.

LAMP-HANGER.

Having experienced the inconvenience of the ordinary non-adjustable electric lamp, Mr. H. J. Harrison, of Juneau, Alaska Territory, conceived of an arrangement similar to the usual shade-roller, whereby the lamp could be raised or lowered at will to any desired position without interfering in the least with the proper transmission of the electric current.

The construction of this device is shown in our illustration. Flexible conducting-cords or wires connect the lamp to a spool or winding drum on which the cords are coiled when the lamp is raised. Through wires leading into the spool, these conductors are electrically connected to conducting pins inserted into the hollow trunnions of the spool. These trunnions find bearing in the depending arms of the lamp hanger frame and are properly insulated from the pins. Connected to the poles of the electric circuit are two spring arms which bear against the projecting ends of the conductor pins and supply current to the lamp. Each spring arm is held in place by a small projection found thereon, which enters a center hole in its respective conductor-pin. Directly above the winding drum is a shaft, also mounted in the depending arms of the frame. At one end of this shaft a large gear wheel is fastened which engages a pinion on the winding drum below. At the other end a coil spring is secured which tends to wind up the drum whenever the latter is released from the retaining device. The retaining device is seen at the end of the winding-drum and consists of a notched disk held by detents just as the ordinary shade roller is held.



ADJUSTABLE ELECTRIC-LIGHT HANGER.

This construction fills all requirements. A quick, downward pull releases the holding device and permits the lamp to be raised to any desired position, where it is held by the detents entering the notched disk. No interruption in the flow of the current takes place, for the spring arms are continually bearing against the conductor pins and supplying the lamp with electricity.

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The Endurance Tests and Speed Trials of the Automobile Club of America.

On Decoration Day the second automobile endurance tests of this year—a one hundred mile trip from New York to a point opposite Green's Farms, Conn., and return will be run off under the auspices of the Automobile Club of America. Probably not over fifty vehicles will participate in the test, as the entries have not been as numerous as was the case in the Long Island Club's run, owing, no doubt, to the fact that the Connecticut roads are by no means as smooth as those on Long Island, and the hills are much more numerous. The prohibitions the Automobile Club has made against racing have also had a salutary effect in keeping out of the contest those who go in for speed and attempt to keep in the background the real purpose of the test. It is interesting to note that whereas in the recent endurance run on Long Island, steam and gasoline machines were about evenly represented, in this run only one-fourth of the entries are steam. Another significant fact is that in both contests the electric carriage was not represented, although every inducement was made the manufacturers of such vehicles, by allowing them to change or replace batteries at suitable points *en route*. Although the electric carriage is the most perfect machine the Americans have produced, and with the present batteries is capable of being used for touring in some sections most luxuriously, no manufacturer seems willing to demonstrate its capabilities on long journeys, as has been done in France and England. A 7 horse power Baker electric has been entered in the speed trials, however, and this will be something of a novelty.

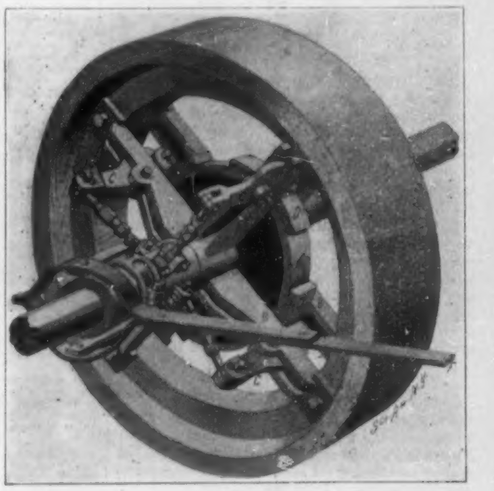
The speed trials will be held on Staten Island, May 31, on a straight course.

The time will be taken for the mile and kilometer, as covered from a flying start. It is hoped that records will be beaten and new ones made, although in the absence of some of the millionaire racers, fewer powerful machines are entered than was the case before.

◆

FRICTION CLUTCH PULLEY.

Two Illinois inventors have just received a patent on a clutch pulley of novel design. The arrangement of the pulley permits a powerful grip on the driving shaft which may be easily thrown on or off by the operating lever. The construction is fully brought out in the accompanying illustration, in which the invention is shown as applied to a wooden pulley. A clutch disk, *A*, is secured to the driving shaft, and the pulley rim is supported by two webs, *B*, mounted at each side of this disk. These webs, as shown, have four arms each which extend from the hub portions and at their outer ends are bolted to an inner ring of the pulley rim. A series of levers, *C*, extend through, and are fulcrumed to, the spokes of one of the webs. These levers have their inner ends projecting over the clutch disk and carry clutch members, *D*, provided with working faces of leather or analogous material. The working faces are dovetailed into place, and when worn out may be easily removed and replaced by others. The outer ends of the levers are connected by rods and turnbuckles in such a manner as to form toggles which are actuated by sliding the sleeve, *E*, on the driving shaft. This is accomplished by operating the lever, *F*, which is connected with a collar mounted on the sleeve. By throwing the toggles the clutch members, *D*, may be engaged with the disk and thus the wheel or pulley will be fastened to the shaft. Upon disengaging the clutch members from the disk, the pulley will be rendered loose. When thrown out of engagement, not only the pulley itself stands still, but also the clutch devices, and therefore the parts are exposed and may be adjusted at will, notwithstanding that the driving shaft may be turning rapidly. Proper adjustment can be made of the toggles by turning the turnbuckles. The disk, *A*, serves the secondary purpose of holding the pulley on the shaft, it being necessary to fasten the disk only to the shaft. The parts of the pulley are then assembled about the disk and thus held in place. The inventors of this device are Messrs. T. J. O'Brien and H. L. Allen, Cairo, Ill.



POWERFUL FRICTION CLUTCH PULLEY.

◆

A combined pilot buffer and coupler has been designed and patented by W. H. Lewis, superintendent of motive power, and C. A. Seley, mechanical engineer of the Norfolk & Western system. The coupler is of the standard M. C. B. form and the shank is cored out longitudinally to form a recess for the reception of the buffer springs.

RECENTLY PATENTED INVENTIONS.

Electrical Apparatus.

ELECTRIC COUPLING. — T. C. JAMES, Manistee, Mich. The electric coupling is designed particularly for connecting signal wires between the cars of a railway train. It provides a joint of simple construction so arranged that should the sections be separated, either intentionally or through accident, the circuit will be completed in each section, and will therefore not interfere with the signaling system.

Machines and Mechanical Devices.

WEIGHING-MACHINE.—C. B. COMEGYS, Ashgrove, Mo. The machine is designed to weigh out merchandise by its value—that is to say, when properly set, to weigh out the worth in merchandise of a certain sum of money and to automatically cut off the merchandise when the proper amount has been delivered.

UNIVERSAL PRINTING-MACHINE.—C. L. DAWSON, Jacksonville, Ill. This machine will quickly and cheaply print announcements in letters of large size, and is particularly adapted for use of stores, real estate agents and others. The apparatus comprehends a universal letter type which is constructed in separate sections, so as to be capable of printing any letter or numeral by a selective action which brings into printing position such of the sections as are required for any particular letter.

CLUTCH.—E. DYSTERUD, Monterey, Mexico. The clutch is designed especially for use in connection with alternating-current electric motors. It comprises a clutch member carried by a rotary part of the motor and controlled by centrifugal force, this clutch member working with the second member fast on the shaft which is to be driven. When the motor is revolving at low speed the shaft is not driven therefrom; the centrifugal force, however, attending a revolution at high speed causes the clutch members to be engaged and the shaft is driven.

EMBOSSING-MACHINE.—I. CLAPPER, Osnaburg, Ohio. The machine affords improvements in embossing or printing ornamental designs on hollow building blocks or tiles during the process of forming the same, and is so constructed as to permit ready adjustment of the embossing cylinder for any desired depth of impression.

CARDING-MACHINE ATTACHMENT. — C. D. INGRAHAM, Penacook, N. H. Mr. Ingraham provides a new and improved carding machine attachment for preventing any of the stock from passing over the ends of the cylinder and going to waste and causing all the stock in the lap to pass to the doffer to insure formation of a lap of uniform thickness throughout its width.

MACHINE FOR MAKING BASKET-COVERS.—C. ENGBERG, St. Joseph, Mich. This invention, relating to machines for making covers for baskets and other receptacles, involves certain novel mechanism concerning the holder for the work and the means for rotating or otherwise actuating the holder as it co-acts with the stapling or nailing device.

MACHINE FOR POLISHING RINGS.—G. H. GASKINS, Portsmouth, Va. Mr. Gaskins provides a ring-carrier for the rings to be polished, a polishing strap to operate between its ends on the ring, and a carrier for this strap which is capable of reciprocation. The inventor informs us that the machine has been built and is now running successfully and giving satisfaction in the United States Navy Yard at Norfolk, Va.

Medical Apparatus.

APPLICATOR.—G. J. VAN SCHOTT, Passaic, N. J. The invention provides a new and improved applicator more especially designed to enable the patient, unaided by a physician, to apply medications to the cervix uteri or to the cervical canal without danger of injuring any of the interior parts of the vagina and womb.

BURNER AND INHALER.—W. R. WARNER, Vergennes, Vt. The burner and inhaler is arranged to permit the user to burn suitable herbs or drugs in a very convenient manner and to bring the fumes arising from the burning process directly to the mouth or nostrils of a patient to insure proper application of the fumes without waste of the herbs or drugs.

Miscellaneous Inventions.

PIPE AND FLUE CLEANER.—C. F. CRADDICK and G. W. FABLIN, JR., Butte, Mont. This simple and practical device affords effective means for the loosening and removal of soot accumulation from the interior of a stovepipe and also from the ordinary chimney flue in a dwelling. It further affords an efficient implement for removing an obstruction from a sewer pipe or the like.

HEEL FOR BOOTS OR SHOES.—J. G. REA, Paterson, N. J. The heel can be readily secured in position and the worn-out sections removed and interchanged or replaced by new ones. It comprises a plurality of rubber blocks clustered together and secured by a circumscribing endless metallic band.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

THE NATION'S BASKETS.

The Mergenthaler-Horton Basket Machine Company is making great preparations for handling the big basket contracts which are offered to it. An order has just been given out for the manufacture of 100 new machines for making 8-pound grape baskets. These 100 machines combined will have a capacity of 400,000 8-pound baskets per day. Some idea of the immensity of the demand for this size of baskets may be gathered from the fact that the contracts which are now offered to the Company for baskets of this size alone will require the running of these 100 machines 10 hours a day 300 days in the year.

Four hundred thousand baskets per day for 300 days is 120 million baskets. If anyone were to see one or two millions of baskets piled up together, he would imagine that there were enough baskets in the pile to pack the grapes of the universe. Yet the State of New York alone demands at least one-half of the 120 million of 8-pound grape baskets, which these machines of the Basket Company will make each year.

There is a net profit to the Basket Company of not less than $6.00 per thousand on all baskets of this size. And this profit of $6.00 remains after reducing the selling price of baskets $2.00 per thousand below any wholesale price ever made. It can therefore be easily seen that the product of these machines alone will earn a net profit to the Company of $720,000 per year, or over 7 per cent on the entire capital stock.

THE 5-POUND GRAPE BASKET.

The demand for 5-pound grape baskets is fully as great as for 8-pound grape baskets. The Company has already been compelled, for lack of machines, to refuse an order for 45 million 5-pound grape baskets for this year's crop. It now has machines to the number of 26 in operation making 5-pound grape baskets, and will place an order for 75 more of these machines just as soon as it can be done without retarding the work of the 100 machines already referred to as being made to make 8-pound baskets.

PROFIT ON GRAPE BASKETS.

Before this time next year these 200 machines will be working steadily, turning out baskets for next year's crop. The profit on 5-pound grape baskets, as handled by this Company, amounts to a little over $5.00 per thousand net. The number of baskets which these 5-pound machines will make each year is fully as great as the number which the 8-pound machines will make. Figuring it as 120 million of 5-pound baskets at a profit of $5.00 per thousand, and it is easy to see that this item will add $600,000 a year to the Company's profit, or a total for grape baskets alone of $1,300,000, which is over 13 per cent on the entire capital of the Company, earned by the business in grape baskets which the Company's automatic machines absolutely control.

QUART BERRY BASKETS.

The volume of business in quart berry baskets amounts in dollars and cents to fully as much as the volume of business in grape baskets, and this Company's equipment for making the quart berry basket is being rapidly extended. At the present time there are already 8 berry basket machines in operation. These machines have a capacity of 12,000 berry baskets per day each, or a total of 96,000 berry baskets per day. Negotiations looking toward the completion of a contract for the manufacture of 50 more of these berry basket machines are going forward as rapidly as possible. When these machines are completed, which will be within a few months, the Company's capacity for making berry baskets will be about one and one-half billions per year.

The selling price of berry baskets at the lowest rate known anywhere is $2.25 per thousand; this Company is prepared to sell these berry baskets at $1.60 per thousand and make a net profit of $1.00 per thousand out of this for every thousand baskets made. More than one-half of the entire berry basket business is already offered to this Company, and it is merely a question of the completion of the negotiations when the entire demand for berry baskets will be turned over to this Company to supply. It is absolutely certain that the whole berry basket business will be contracted to this Company before its machines can possibly be completed to turn out the work. A very simple calculation on the volume of berry basket business, as stated above, sold at the unheard-of low price of $1.60 per thousand, out of which the Company makes a clean $1.00, will add one and one-half millions more to the yearly profit of the Company. This will make a total of profit earned on grape baskets and berry baskets of $2,800,000 per year, or 28 per cent on the entire capital of the Company.

THE TILL BASKET.

Next in order of calculation is the basket known as the Till Basket. This basket is used for the shipment of peaches from Georgia and the Southern States; for the shipment of plums and for the shipment of tomatoes from all the Southern points to the Northern markets.

The Mergenthaler-Horton Basket Machine Company has just perfected a machine for the manufacture of these "till baskets." This machine works on the same principle as the machine for making quart berry baskets, and will turn out these "till peach baskets" at the same speed that the berry basket machine turns out berry baskets, which is 12,000 per day.

35 PER CENT TO 40 PER CENT ON ENTIRE CAPITAL.

From the fragmentary statistics which it has been possible to secure, and the offers that have been made to the Company of orders for this class of baskets, it is entirely reasonable to believe that the Company's profit on this class of baskets alone will amount to over $1,000,000 per year. Adding this profit to the figures already demonstrated in the foregoing, and it becomes an immediate commercial certainty that the Mergenthaler-Horton Basket Machine Company will earn a profit for its shareholders amounting to between 35 and 40 per cent on the entire capital of the Company, without taking into account at all the tremendous volume of business which it is making preparation to handle on the Pacific coast. This volume of business from California, Washington and Oregon is very large. Last year the shipments of fruit east from California amounted to over 200 carloads per week for eight months in the year. The baskets for the handling of this great California and Pacific coast demand will add very largely to the Company's profits. No figures could now be made on this field of operations which would have a sufficiently authentic basis to warrant the effort in setting them forth, but everyone who gives the matter an instant's thought, can see that the expectation to handle the entire basket trade of the Pacific coast is an entirely justifiable one, and indeed overtures of business from the fruit people controlling the California trade, are already in progress.

An illustration of the superiority of the automatic machine labor over hand labor in the matter of speed and excellence is given at the exhibitions this Company is carrying on in New York, Chicago, Boston and Philadelphia, and will shortly be opened in St. Louis, Buffalo and Pittsburg.

Shares of the Mergenthaler-Horton Basket Machine Company's stock are now being sold at 75 cents a share (par value $1.00 full paid and nonassessable). It will be seen from the resume of the basket situation as herein set forth, that no more attractive opportunity for the investment of small or large sums can possibly be found, than in the shares of this Company.

Checks for subscriptions should be drawn to the order of Charles R. Barlow, Treasurer. The Directors reserve the right to reject any subscription. No subscription accepted for less than 50 shares. The price of shares in this Company will be advanced almost immediately, and may be advanced without further notice. The executive offices of the Company are at 287 Broadway, New York.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 2626.—For a machine for putting cylinder heads in piling after being driven.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 2627.—For manufacturers of adding machines.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 2628.—For engine lathes and machines for making stoves with electric motors attached.

For mining engines. J. S. Mundy, Newark, N. J.

Inquiry No. 2629.—For machines for making white bone substitutes.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 2630.—For makers of broom machinery.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 2631.—For makers of marine engine castings.

We design and build special and automatic machinery for all purposes. The Amstutz-Osborn Company, Cleveland, Ohio.

Inquiry No. 2632.—For *ball* ball-bearing casters for use in rolling mills in handling sheets, being a ball which will revolve in any direction set on ball-bearings.

Automobiles built to drawings and special work done promptly. The Garvin Machine Co., 149 Varick, cor. Spring Streets, New York.

Inquiry No. 2633.—For makers of turning lathes.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 2634.—For makers of fountain pen stocks.

Clippings of everything printed on any subject in the American and foreign press. United States Press Clipping Bureau 153 Lasalle Street, Chicago, Ill.

Inquiry No. 2635.—For makers of porcelains for spark plugs of gasoline motors.

Designers and builders of automatic and special machines of all kinds. Inventions perfected. The W. A. Wilson Machine Company, Rochester, N. Y.

Inquiry No. 2636.—For parties to make engines out of aluminium.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 2637.—For a kerosene oil burner to generate 400 deg. of heat within four hours from the time of lighting.

IDEAS DEVELOPED.—Designing, draughting machine work for inventors and others. Charles E. Hadley, 584 Hudson Street, New York.

Inquiry No. 2638.—For a machine for covering wire with silk.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 2639.—For a machine for forming grass into twine by winding it with thread.

INVENTORS, ATTENTION!—Highest prices paid for novelties in card or paper. Established 30 years. Address The Tablet and Ticket Co., No. 87 Franklin Street, Chicago, Ill.

Inquiry No. 2640.—For makers of double-action suction pumps.

THE MODERN CORPORATION.—Information about incorporation, advantages, expenses, etc., new book, 90 pages, vellum, 56 cents, postpaid. Send stamp for sample pages. The Ronald Press, 170 Broadway.

Inquiry No. 2641.—For the manufacturers of the Acme oil and gas engine.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Inquiry No. 2642.—For dealers in counting machines to be attached to typewriters or cash registers.

Inquiry No. 2643.—For dealers in well-drilling machinery.

Inquiry No. 2644.—For dealers in aluminium or "flowered" tin picture frames.

Inquiry No. 2645.—For makers of small gasoline engines of 2 h. p. or less.

Inquiry No. 2646.—For a foot or electric power machine for cutting cloth in ovals or scallops.

Inquiry No. 2647.—For makers of car-building machinery.

Inquiry No. 2648.—For a stationary gasoline engine for running a small plant for cutting stones.

Inquiry No. 2649.—For a power pipe-threading and cutting machine for cutting pipes 2 to 6 inches.

Inquiry No. 2650.—For makers of sewage disposal plants.

Inquiry No. 2651.—For makers of electric mining drills and general mining machinery.

Inquiry No. 2652.—For ax handle and spoke machinery.

Inquiry No. 2653.—For manufacturers of celluloid or hard rubber goods.

Inquiry No. 2654.—For makers of coal briquettes.

Inquiry No. 2655.—For manufacturers of lithographic stones.

Inquiry No. 2656.—For the manufacturer of the Grabler check protector.

Inquiry No. 2657.—For dealers in useful industrial toys.

Inquiry No. 2658.—For dealers in oil drills and machinery for operating the same.

Inquiry No. 2659.—For makers of netting machines, especially for hammocks.

Inquiry No. 2660.—For manufacturers of nut crackers.

Inquiry No. 2661.—For dealers in hat creasers.

Inquiry No. 2662.—For dealers of aluminium in sheets.

Inquiry No. 2663.—For parties to engage in the construction of airships and light engines per horse power.

Inquiry No. 2664.—For parties to make, in large quantities, a small iron casting similar to a toy.

Inquiry No. 2665.—For parties to manufacture rubber rings.

Inquiry No. 2666.—For manufacturers of spring motors.

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May 20, 1902,

AND EACH BEARING THAT DATE.

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Elevator safety appliance, S. B. Trapp	700,458
Elevator signal device, S. D. Collett	700,619
Endless belt feed or carrying apparatus, B. M. Bishop	700,474
Engine. See Compound or multiple cylinder engine.	
Engine reversible device, Hage & Waller	700,639
Engine speed regulator, explosive, R. A. F. Belfuss	700,401
Envelop or wrapper, reversible, W. Masters	700,352
Extensible trough, P. Maginnis	700,522
Extension table, C. W. Munz	700,222
Eyeglasses, A. B. Critzer	700,623
Fabrics, machine for fixing spangled material to textile, R. Cornely	700,305
Fan governor, H. Koch	700,511
Fare register, A. Nielsen	700,703
Fastener for satchel purses, etc., A. & J. Hinkel	700,329
Feed regulator, Moore & Totman	700,219
Feed water filter and heater, J. Davie	700,626
Feed water regulator, C. M. Spencer	700,449
Fence machine, woven wire, F. Stebler	700,710
Fence post, Smith & Bisbee	700,383
Fence post, C. Leall	700,431
Fence post making machine, Smith & Bisbee	700,252
Fender, A. Beck	700,716
Fertilizer distributor, W. P. Mize	700,533
File and cabinet, letter, W. S. Grange	700,417
File, card index, G. F. Watt	700,391
File, document, E. G. Waters	700,267
Fine fuel furnace, R. Herzberg	700,198
Finger ring, initial, F. G. Frey, Jr.	700,637
Firearm, revolver, W. J. Whiting	700,592
Fire escape, J. C. McCombie	700,543
Fire extinguisher, W. H. Banfil	700,603
Fire extinguisher, R. M. Martin	700,696
Fire extinguisher, automatic, H. C. Montgomery	700,218
Fire extinguishing systems, main valve for, H. Eversmann	700,187
Fish line reel, E. D. Rockwell	700,559
Fishing reel, E. vom Hofe	700,424
Flexible coupling, C. L. & R. A. Schultz	700,246
Floor boards singly, instrument for removing, J. M. Cammack	700,169
Fluid operating device, J. Hartness	700,646
Fluid regulating device, J. Hartness	700,644, 700,645
Fluxing and separating compound, A. D. Miller	700,529
Form, adjustable sleeve, M. C. Moran	700,539
Fruit juice extractor, C. Pate	700,668
Fuel, artificial, Tucker & Cory	700,389
Furnace, See Blast furnace. Fine fuel furnace.	
Furnace, W. W. Peasley	700,230
Fuse box, multiple, J. D. Lytle	700,695
Fuse cut out, plural, C. J. Dorsey	700,410
Fuse, time, O. Hartmann	700,643
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Garment hook, T. D. Richardson	700,372
Garment, nether, B. M. Crouse	700,177
Garment stretcher, J. H. Youmans	700,595
Garment supporter, W. S. Hunkins	700,498
Gas burner, Keller & Seiler	700,205
Gas burner, indandescent, C. W. Taylor	700,574
Gas, charging compartments with, Moore & Martin	700,538
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Gas heater, E. A. Monjo	700,535
Gas impact engine, L. Wilson	700,277
Gas pressure regulator, D. L. Block	700,403
Gas purifier grid, C. R. Faben, Jr.	700,188
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Glass delivering apparatus, W. D. Keyes	700,428
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Golf balls, manufacture of, E. Kempshall	700,655, 700,657
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Grain drill, W. Fetzer	700,315
Grain preparatory to grinding, apparatus for treatment of, G. Bianchini	700,472
Graining apparatus, G. A. Hersog	700,493
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Type justifying machine, J. Watson	700,712
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Vehicle brake, automatic, J. E. Austin	700,287
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Vehicle wheel, G. S. Lee	700,514 to 700,516
Vehicle wheel, D. H. Haywood	700,680
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Wheel, J. Macphail	700,215
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Wheel tread, W. L. Judson	700,333
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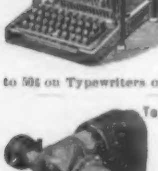

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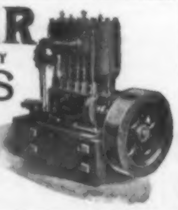

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METALLURGY OF CAST IRON. By Thomas D. West. Third Edition. Cleveland, Ohio: The Cleveland Printing and Publishing Company. 1900. 8vo. Pp. i-xvi, 627.

The author, who has had a wide experience as a molder and founder in loam, dry and green sand work, in the specialties of founding, has prepared this book with the object of making it valuable not only to the founder, the molder, the blast furnaceman, the chemist, the draftsman, the pattern-maker, and the college specialist, but to all who may in any way be desirous of obtaining a working knowledge of cast iron in its application to founding or allied interests. The book, which is in its third edition, has been thoroughly revised, much material having been added on the making, mixing, melting and testing of cast iron, part of which constitutes twenty new chapters, including researches, experiments and discoveries. This work, which has had a notable effect upon foundry practice, advocates methods much in advance of the old-school practice.

PLANE SURVEYING. By Paul C. Nugent, A.M., C.E. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. 1902. 8vo. Pp. xvi-577.

It has been the author's purpose to present the principles of his subject by the deductive method, and to direct attention to special cases and to questions likely to arise in the mind of the student. In arrangement and in treatment the book departs from the accepted works on surveying. Among the most valuable chapters in the book may be mentioned those on the planimeter and mine surveying.

THE COPPER HANDBOOK. 1902 Edition. Compiled and published by Horace J. Stevens, Houghton, Mich. Pp. 416. Octavo.

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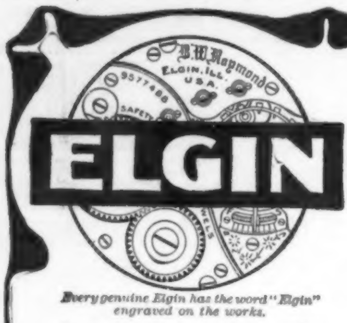

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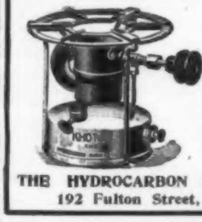

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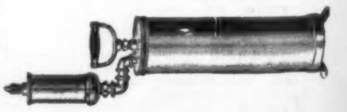

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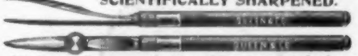

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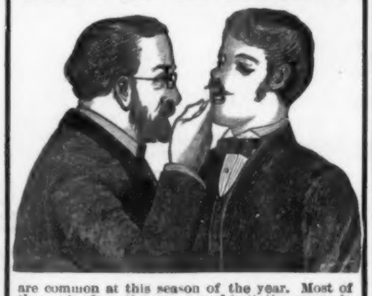

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(8612) A. B. writes: The primary is No. 16, silk-covered wire and is wound around an axis ¾ inch diameter and 4½ inches long. I wind about 300 turns of it. The secondary is formed of 11 ounces of No. 36 silk-covered wire wound around an axis 1¼ inches. I use a bichromate cell. Please give me the number of volts, and the length of spark I can obtain from it. Also tell me if a smaller number of turns in the short circuit would give more E. M. F. in the long one; and also about how many turns I should use. The soft iron inside the ¾-inch axis is ½ inch diameter and formed of 167 wires. A. The coil may give a spark a half inch long. We are not able to determine the voltage, except as a spark of a certain length indicates it. The primary of such a coil should not have more than three layers of wire. You may need to put on more than one cell to bring out the longest spark the coil can give. Norrie's "Induction Coils," price $1 by mail, contains data from which you can build coils of a great variety of sizes.

(8613) J. P. J. asks: Please let me know what a voltmeter would do or indicate, if connected in series with a motor or any load, if built to stand the E. M. F. of the dynamo. A. If a voltmeter were connected in series with a motor, it would simply cut down the current which the motor could obtain and prevent the motor from running. A voltmeter has a very high resistance, so that very little current can pass through it. The motor cannot get any more current than can pass through the voltmeter. Hence it will not run in series with a voltmeter. No harm would come to the voltmeter by connecting it to the circuit in this way. A voltmeter is always connected across the poles of a circuit, and takes the full voltage. In series with a motor it would not get the full voltage of the circuit. It would be less affected than when put across the poles of the circuit.

(8614) J. H. H. asks: 1. Will you please tell me the name of some book in which is given a clear and full description of the construction of a dynamo which also tells how the current is made? A. Swoope's "Lessons in Practical Electricity," price $2 by mail, will probably give you the most information upon the topic of any single book. Thompson's "Dynamo-Electric Machinery," price $6 by mail, is the most thorough book on the subject. 2. Also a book that gives a full description of the telephone. A. Miller's "American Telephone Practice," price $3 by mail, is the book you need. 3. At the B. & O. R.R. station here there is a *yellow* and *black* semaphore. What is it for? A. You should ask some one of the railroad men to find this out. 4. What is the steam-dome on a locomotive for? A. To dry the steam. 5. In the pictures of some locomotives there is a small wheel behind the drivers. What is it called, and what is its use? A. To carry the weight of that part of the engine directly over it. 6. In the accompanying drawing, if *a b* were a steel pole it would evidently complete the circuit between the wire, *f*, and the ground. Now, if, at the same time, a person were to touch the pole at *c* and the ground at *d*, the current would still pass through the pole and not through the person. In other words, if there were two passages for the current, why would it choose the pole in preference to the person? A. Whether a perceptible current will leave the pole and go through the person depends upon the voltage of the current. The body of the person acts as a shunt upon the pole. It will receive a portion of the current. See the calculation of shunts in Swoope, referred to above.

(8615) W. V. S. writes: Kindly give me, through your Notes and Queries column, a formula to produce the verde finish on brass, in the electroplating bath. A. Various methods of producing verde or green shades upon brass and other metals are to be found in "Modern Electro-Plating," price $1 by mail.

(8616) C. A. C. asks: What is the meaning of the term cycle in engines, such as two-cycle and four-cycle gas engines? A. A cycle is a series which returns upon itself. A two-cycle is a single impulse of the piston or ignition, for two strokes or one revolution. Four-cycle is one impluse or ignition to four strokes of the piston or two revolutions.

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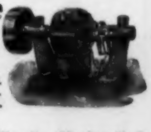

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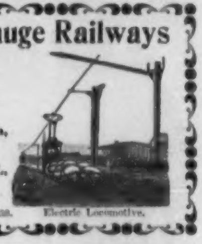

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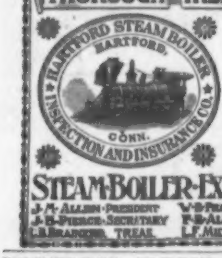

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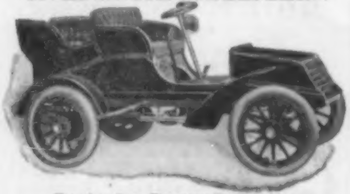

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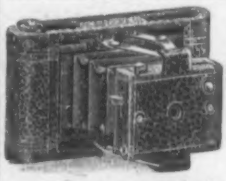

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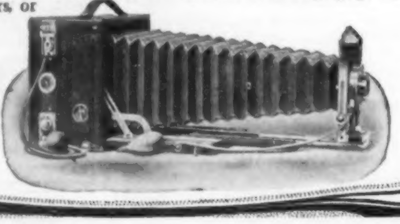

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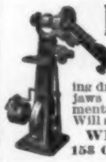

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